

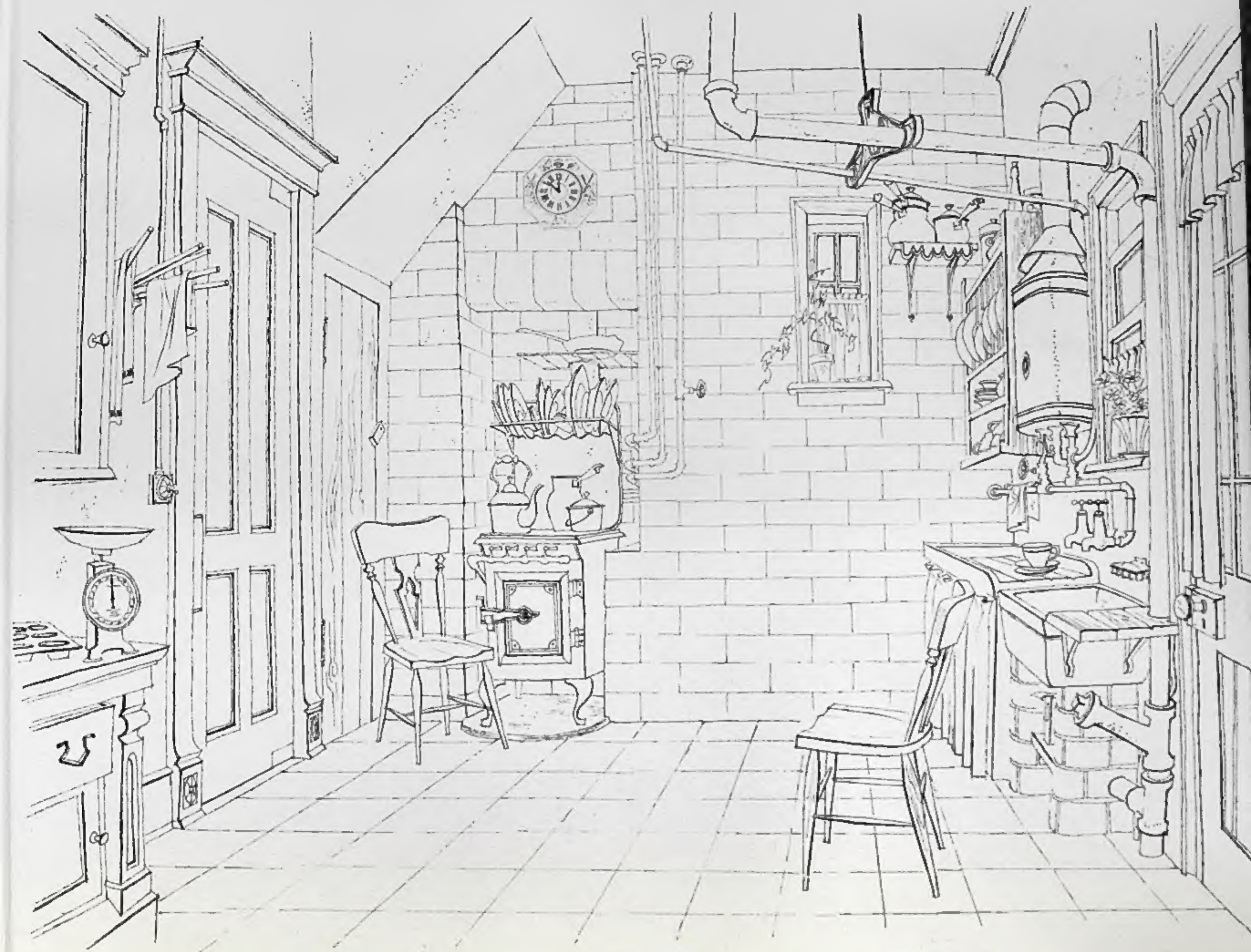
SETTING the SCENE

THE ART AND EVOLUTION OF ANIMATION LAYOUT



FRASER MACLEAN

FOREWORD by PETE DOCTER



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The Art & Evolution of Animation Layout

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CHRONICLE BOOKS
SAN FRANCISCO

— FOR —
Colin, Moira & Ethel

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Back cover: Painted background artwork (case) plus ink line and
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— FOREWORD —



OPPOSITE: The young Carl Fredrickson caught up in his hero, Charles Muntz's, story.

Film Still

Up (2009)

Directed by Pete Docter & Bob Peterson

There are several possible reasons that you, the reader, may have picked up this book. Perhaps you are a fan of animation and want to know more about how layout is done. Maybe you are a student, hoping to gain knowledge that will be of value to you professionally. Or possibly you've been accidentally trapped in a walk-in meat locker, and this book is the only thing in there besides frozen flank steaks, and reading it is the only thing keeping you from falling into the icy oblivion of eternal slumber. Of course, if the only non-meat item in there is a book on animation layout, I would suggest there might be something more sinister afoot than a mere "accident." Perhaps there were telltale signs you missed that now, given time to think, will come rushing back to you in a flash of insight. Ah, well, too late.

The good news, regardless of your situation, is that I think this book will satisfy your yearnings. There is a lot of useful information herein, most of which begins after this introduction, in case you haven't already gathered that much.

Here's the thing about layout: it's a lot like an actor on stage. I may have written him brilliantly funny lines, but unless that actor delivers them correctly, the audience won't laugh. They may even throw things. And then they'll say, "What a lousy director," and chase me with sticks. The point is it's easy to kill a great joke, dramatic reveal, or poignant tragic turn if you don't stage it right. And that, my friend, is the job of the layout artist: to protect me from people with sticks.

Which would you rather watch: a great idea told lousily, or a lousy idea told well? If you're like me, you'd go for the second. In fact, I could argue that there is no such thing as a lousy idea if it's told well. (Especially if the idea is about baked beans.)

Well, then, if it's so important, what makes layout "good"? First and foremost, a layout must simply and clearly communicate the information needed to further the story. You'd be surprised how often shots fail at this basic job. Filmmakers tend to get complicated, fancy, or artsy. We get

distracted by the design itself, or caught up in the beautiful color and lighting. But if our image doesn't put across the basic story point, it's not doing its job. Even filmmakers famous for elaborate camera work keep things simple more often than not. Scan through any Alfred Hitchcock films, and you'll notice that complex shots are the exception. And when he does them, they always tell the story.

Early animation layout artists, as well as D.W. Griffith and other early live-action filmmakers, unabashedly studied the Masters before them: Rembrandt, Vermeer, Gustav Doré. These artists realized their images were more than just the objects they captured in paint; they were telling a story, a moment of life frozen in time. Everything in that composition—the placement and size of the characters, the relationship of the figures to the frame and each other—contributes to its meaning. Change one thing and it may mean something else. Layout is storytelling.

Of course, there are numerous elements that go into making a composition communicate. Shape, graphic direction, color, lighting . . . many of these will be discussed in this book. Unfortunately, the ultimate, magical secret to layout will be covered

only in my own upcoming book, *Pete Docter's Ultimate Magical Secret to Layout*. Oops, I promised Fraser MacLean I wouldn't plug that.

Beyond clear composition, layout has another, deeper job: subliminal advertising. What I mean is that a filmmaker often tries to convey a feeling, and attempts to do so in a sneaky way of which the audience isn't even conscious. A phone can ring ominously, a fire blaze joyfully, a staircase can loom oppressively or ascend up hopefully—all done with the layout. The way a subject is presented can be the difference between making a connection with the audience and having them fall asleep.

In movies, facts are meaningless. All we audience members care about is how those facts affect the character. Is it good or bad? We experience the story through the eyes of the protagonist. And the way we do that is through layout. All stories are at its mercy.

Read this book and tell your story well!

—Pete Docter

— INTRODUCTION —

HAND-DRAWN CINEMATOGRAPHY



To date, the history of cinematography has tended to focus on directors of photography (DPs) and lighting camera people working with live actors, either on location or in studio sets. The movie images these people create are a product of lens and light, not pencil and paper. In their world, drawing is a tool of the set designer and the art director. To students of screen craft, then, the idea that cinematography itself can be created by draftsmen may seem a little odd.

But the word “photography” was itself originally created in the late 1830s from the Greek words *photos* (light) and *graphos* (drawing). The resulting, rather poetic notion of “drawing with light” already brings us pretty close to a workable idea of what the pioneers of animation layout were doing by the middle of the following century, but the term “cinematography,” which the Lumière brothers arrived at in the 1890s by introducing yet another Greek word, *kinesis* (movement), rounds out the idea by implying a kind of mark-making on paper that encompasses both light and movement.

The idea of paintings, sculptures, or illustrations coming to life has been active in Western mythology for thousands of years—but it’s worth remembering that, in the wake of Muybridge’s groundbreaking photographic studies of human and animal locomotion in the late 1870s, the very medium of “moving pictures” was first brought before an indoor audience as much by illustrators as by photographers. Artists such as Winsor McCay and Otto Messmer understood, and were quick to exploit, the power of this new technology; it allowed them to breathe life (and shine light) into their sequential “cartoon” drawings, which, until then, had remained trapped in the flat space of a printed page.

The recent proliferation of animated content on television, in advertising, and on the Internet has helped familiarize the world at large with many of animation’s production disciplines, most notably character animation and digital special effects. But even such open access to the “backstage” world has done little to explain the pivotal role of layout in

the commercial animation process. Character and effects animation occupy clear production territories, but the sheer scope of the Layout Department’s responsibilities sometimes prevents us from being able to take it all in.

Even today, layout exists more as an idea than as a department in some smaller animation studios, and where Layout Departments do exist, their importance to the production process is often not fully grasped. As the licenses for 3D computer modeling and animation software have become more affordable, art schools and colleges have begun to introduce animation to the curriculum. But even the more established courses sometimes struggle to convince their students (and even themselves, to some extent) that layout skills can and should be taught.

From the late 1930s through to the emergence of viable commercial competitors in the late 1990s, the Walt Disney Animation Studios enjoyed a veritable monopoly on the production and worldwide exhibition of feature-length animated movies.

PREVIOUS One animated environment framed by another; "the fatalistic physics of the Coyote's desert world" as seen on the hero's own projector screen.

BG painting by Philip De Guard, layout by Maurice Noble
Possibly for a discarded shot from *Road Runner A Go-Go* (1965)
Directed by Chuck Jones

In spite of the recent market presence of a profusion of computer-animated features produced by studios other than Disney (or its hugely successful partner studio, Pixar), and even allowing for the dominance at the Japanese box office of the extraordinary films of Hayao Miyazaki's Studio Ghibli, Disney movies old and new continue to reach and affect a greater share of the global audience than those of any other animation producer.

Whatever developments the medium or the market may see in the course of the next seventy years, nothing of technical or artistic significance has happened (or can happen) in isolation from the unique Disney legacy. Indeed it would be impossible to embark on a meaningful exploration of the layout style of any popular animation property, from Warner Bros.' *Looney Tunes* through Blue Sky Studios' *Ice Age* movies, without both reference and comparison to the groundbreaking achievements of Walt Disney Animation Studios' feature film unit.

While the term "layout" still refers to a well-established collection of skills in most traditional animation pipelines, in the digital realm it can often denote a quite separate, though clearly related, set of skills. Because the terminology and definitions of the layout process have continued to shift even as I've been recording them, I have needed and appreciated the help of a great many people in verifying which terms apply only locally within a single studio or pipeline, and which can still be considered universal.

Like any good piece of layout artwork, this book seeks to present all the elements of the story in the clearest possible way. That being said, this is not a how-to book. It doesn't present or itemize layout rules of any kind, although I believe there's plenty of room on the shelf for more detailed and personal accounts of the layout process, historical

BELOW The Huntsman attempts to summon the courage to murder an unsuspecting Snow White.

Story sketch with camera framing (or field) guide; graphite and colored pencil, Disney studio artist
Snow White and the Seven Dwarfs (1937)
Directed by David Hand

and modern, written perhaps by some of the practitioners themselves.

Instead, by presenting archive pencil artwork in the context of interviews with artists and technicians, and by including various exposure sheets, camera diagrams, and character staging sketches (along with a detailed glossary of terms),

OPPOSITE The Queen, disguised as an old crone, struggles to roll a boulder down the mountain to crush the Dwarfs.

Story sketch; graphite, Disney studio artist
Snow White and the Seven Dwarfs (1937)
Directed by David Hand

we sincerely hope that, for the first time, even the casual reader may be able to understand and appreciate the unique contribution made by these creative teams and individuals, not only to the specific animation productions we discuss but also to the universal visual language of popular cinema as a whole.





Dwarfs trapped in path of boulder - Grumpy
"Look out!"



**“WHAT DO
YOU MEAN BY
‘LAYOUT’?”**

The question that comes up more often than any other when discussing the art of layout is, “What do you mean by ‘layout’?” While interviewing the dozens of animation artists and technicians who contributed to this book, sometimes I would ask the question first, at other times the person I was interviewing would begin by asking me for my definition.

One or two of the artists working in layout for contemporary CG (computer graphics) animation studios told me that, in their experience, “layout” was synonymous with “camera” (in the contemporary sense of deciding on the position and movement of a virtual camera); others were keen to assure me that the definition of “layout” in a CG animation studio was closer to what a traditional animation studio would, until recently, have referred to as “scene planning” (see chapter 6).

Preliminary designs for environments and sets are still hand-drawn by concept artists at the pre-production stage in most CG studios, but are not necessarily archived as “layout” artwork per se. At one point, I asked Fox Carney, the tireless curator working with me at the ARL (Disney’s Animation Research Library), whether it might be possible to track down a particularly beautiful multicolored drawing I had seen reproduced in another book, showing the frantic plan of action for Donald, Mickey, and Goofy in a scene from the 1935 short *Mickey’s Service Station*. “Oh,” he told me, “that would be filed under Story Sketch, not Layout.” His response was a reminder that, in place of clear and narrow divisions, there were in fact broad areas of overlap between Layout and each of the surrounding departments.

THE STORY, THE FRAME, AND THE LIGHT

“Before I came here, story and image were separate entities. Now they’re completely connected.”

—Danielle Feinberg, Director of Photography, Lighting at Pixar

I could, I think, be forgiven for getting confused; even within one studio the practice, the

terminology, and the division of labor can vary from production to production depending on which director (or directors) might be in charge of a project and the particular visual medium in which the different departments feel most comfortable expressing and communicating their thoughts, ideas, and plans. Nor has the distinction ever been clear between what constitutes a “3D” studio or a “2D” production, since designers and technicians will inevitably tap into whatever resources, human and mechanical, are available to them in order to achieve the best possible results, as they have done since the earliest days of animation in any of its forms.

It wasn’t so much that I found myself gathering conflicting evidence either, more that I came across an assortment of different threads, some running parallel, some coming to an abrupt end, and others trailing off around corners or becoming hopelessly tangled. Eventually I began to wonder: what, if anything, were the “constants” that all these different artists and technicians had been dealing with for all these years? And, taking all the possible variables into account, I found it was possible to narrow it down to three:

The story, the frame, and the light.

Whether the animated pictures seen by an audience on a screen derive from flat artwork created on a page or from digital geometry modeled in a computer environment, and whether the screen itself is fifty feet across or the size of a playing card, the image itself is always rectangular, and that rectangle is always wider than it is tall. Animation layout, if it can be anchored to any one definition, is the marriage of storytelling and composition; it is the art of placing moving storytelling images within a frame so that they can unfold before us in real time. Our ability to “read” and understand those images within that frame depends not only on bare lines or elaborate rendering, it depends on the play of light and dark and, as layout artist Rob Cardone explained to me, “Lighting is 50 percent of the composition of a shot, and if you’re talking about composition, you’re talking about layout.”

Animation artists from all eras have combined their film work with design and illustration for print, but whereas column and illustration spaces for book, magazine, and newspaper publication can be either horizontal or vertical (that is, “landscape” or “portrait”), to date, cinema, television, game, and Internet screens have all been horizontal in format.

Why? Because we have two eyes and they are arranged in a line, side by side, at the top of our faces. Unless we lie flat or hold our head at a 90-degree angle, we perceive the environment around us in panoramic form, whether it be a tiny attic room or a vast open desert. Although the re-creation of stereo vision for a 3D cinema presentation allows audience members, equipped with appropriate viewing glasses, to believe they are seeing movement beyond the surface of a flat screen, the moving images themselves are still bound by the rectangular parameters of the

A note on this rough BG layout from a 1933 Popeye short warns the BG painter to "render area through which bullet passes so that it won't be lost."

screen. Even with the help of a full "virtual reality" headset, this basic horizontal orientation of the moving image is preserved.

Unlike a book illustration or a painting, both of which are single images upon which our eyes are free to linger, the moving images we see on theater, TV, and computer screens change constantly and are intended not only to engage us emotionally but are, to a degree, designed to convince us that we are observing or have entered into a narrative taking place in an imaginary world that we ourselves might also like to inhabit.

In animation, every component of the on-screen image, from the central subject to the movement of the unseen camera, is manufactured or contrived. For this reason, animation, which is more tightly controlled and more heavily dependent on illusion and on the "willing suspension of disbelief" than live-action, could be thought of as cinema in its purest form. But however we choose to define it, animation (and cinema animation in particular) is an immersive experience based on a whole series of tricks and illusions, none of which can function properly if we become aware of them, even momentarily, at the conscious level.

Just as a conjuror succeeds when the sleight of hand goes unnoticed, the layout team expects to be congratulated only when its work succeeds in keeping the audience involved in the story itself. And this, perhaps, is why "layout" is so easy to miss and so hard to define.

SCARY TREES AND BONGO ZIP-OUTS!

Like many children of the 1960s, I "knew" what animation layout was before I had any idea there was even a name for it. I knew whenever Top Cat and his gang were on the run from Officer Dibble, the chase would run from screen left to screen right and it would invariably take the characters past an endless loop of identical street lamps,

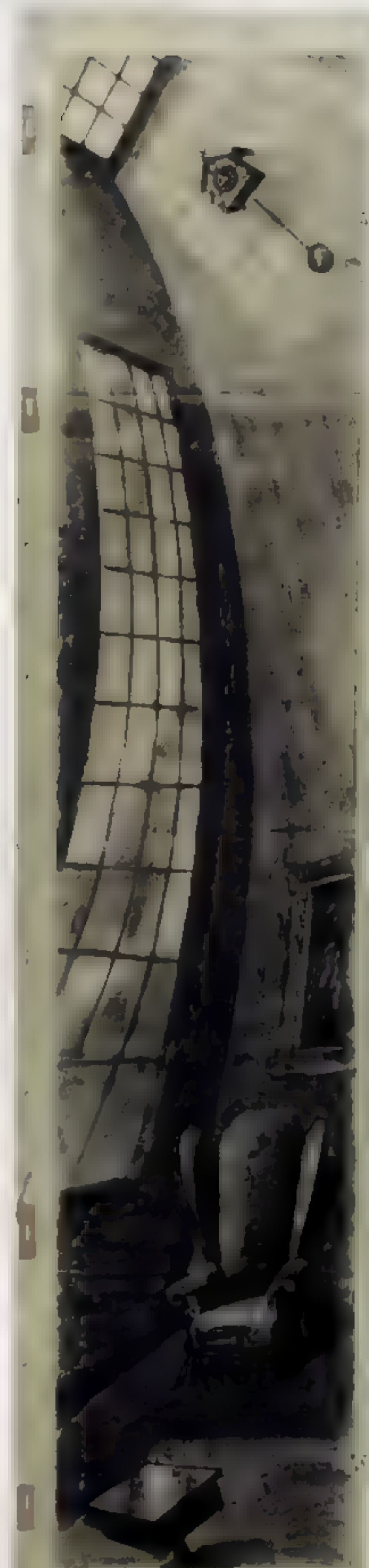
Animation cels and other production artwork can be seen here, piled up around an early Disney animation camera equipped with hand-operated gear wheels for lateral movement of sliding peg bars.



trash cans, and fire hydrants. In sharp and obvious contrast to this, when Snow White was on the run from the Huntsman, not only was the action itself compelling and believable, it took place in a dark, layered forest that had been rendered with an entirely convincing sense of both naturalistic color and depth.

Somewhere in the middle, between the snack-food sugar rush of my favorite Hanna-Barbera shows and the full three-course meal of a Disney feature, early-evening TV reruns of *Tom and Jerry* and weekend matinees of the old *Looney Tunes* shorts proved to me that there was a rich middle ground of design and technique, in terms of both performance and perspective, in animated cartoons.

I may not have known the specific terminology for the different stages of animation production, but for a cartoon to be worth watching (and worth watching again) I knew that it wasn't enough simply for the characters to move. In a really good cartoon, *everything* had to be able to move: the characters, the props, and the environments. And that's pretty much what layout is (allowing for the different toolkits peculiar to the different animation media): it's the art of setting everything—the

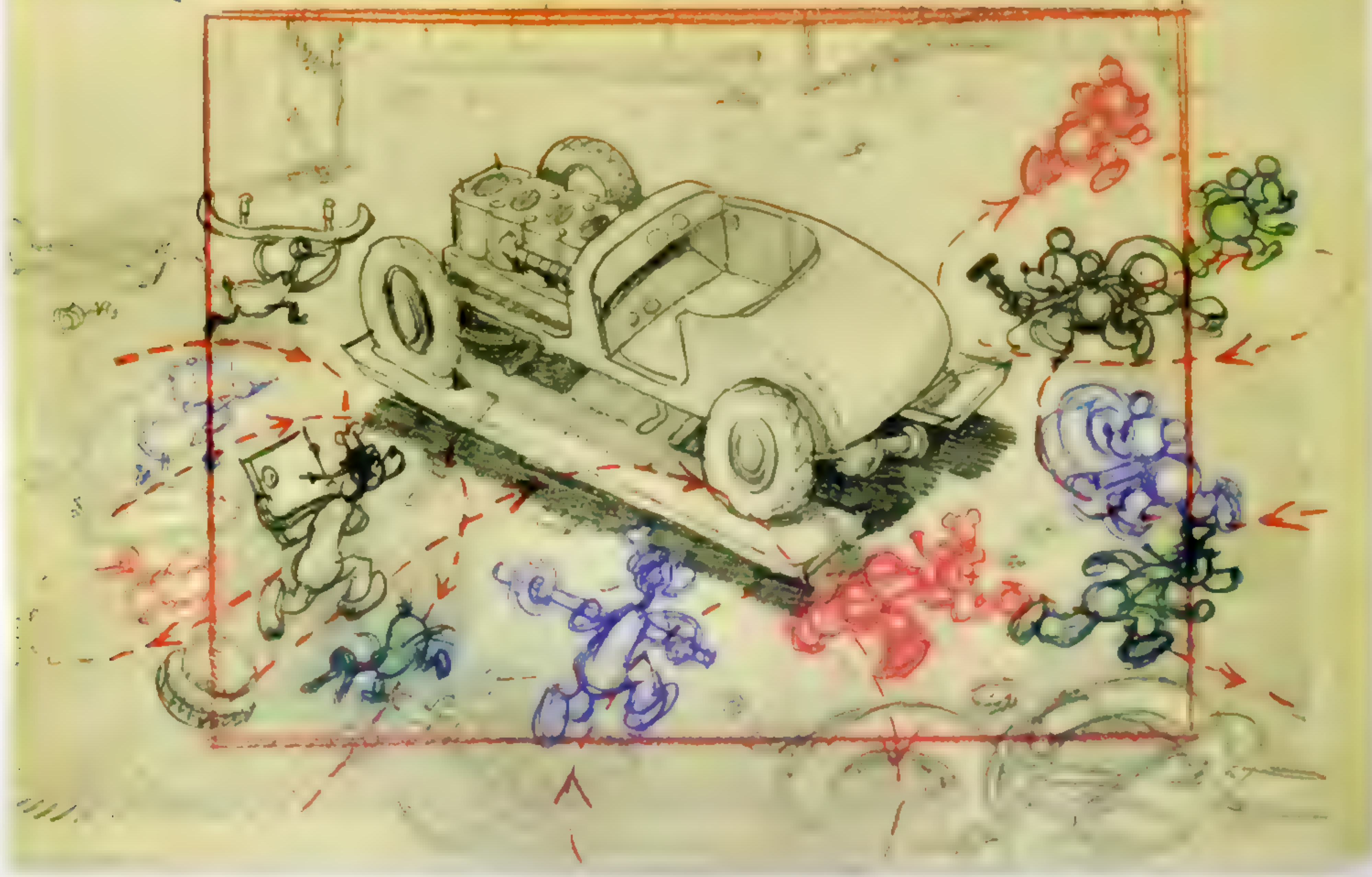


OPPOSITE This BG layout drawing (possibly by Tex Avery himself) demonstrates perfectly the use of a "banana" perspective, designed to create the illusion of a partial camera rotation even though the lens is traveling across flat artwork that remains parallel to the film plane at all times.

BELOW Only by studying and comparing all the completed story sketches can a "traditional" layout artist work out the number of individual backgrounds required to accommodate the action. Where possible, individual background paintings will be used in more than one scene although complex or unusual action, such as the high-speed multicharacter motion indicated in this sketch, may require a unique composition to be laid out and painted.

(SUPER-SPEED ACTION)

2678



Three examples of "repeat" TV background artwork, each displayed as a continuous frieze, all designed for use (and reuse) in chase or fast-action sequences.

OPPOSITE TOP The arrangement and lighting of every prop in this BG layout drawing help to create a clear diagonal camera path, following Jiminy Cricket from a position outside the window to his arrival beneath the door.

Example of design for prop sets. (From *Disney's Artists* (possibly Albert Harter) in *Prop Sets of Disney's Pinocchio*, 1938)
Directed by Hamilton Luske & Ben Sharpsteen

OPPOSITE BOTTOM Mary Poppins (Julie Andrews) interacts with two animated jockeys.

Mary Poppins (1964)
Directed by Robert Stevenson





characters, the environments, *and* the camera—in motion by providing a context and a visual continuity within which everything *can* move freely and legibly.

Today, thanks to home computers and DVD (and Blu-Ray™) players, entire galleries of animation layout and background artwork are available for us to study and enjoy. Sadly, much of the original artwork, particularly from the earliest productions, has been lost or destroyed, and often the artists' notes and camera guides are missing from the surviving material. So while numerous specialist books have been written over the years about the art and technique of everything from traditional storyboarding to facial rigging for 3D computer animation, very little has ever been said (or properly explained) about the rarified art of traditional animation layout as it developed and evolved through the 1920s, '30s, and '40s.

Furthermore, if we fail to appreciate the specific practical problems the Layout Department was originally created to solve, we have little hope of understanding either where layout currently stands or how it may develop and grow in the

future. As we will see from the many illustrations and personal accounts that follow, animation layout began as a peculiar combination of perspective, staging, and applied mathematics that might best be thought of as the most refined—yet least known—form of twentieth-century cinematography: cinematography, if you like, by hand.

TWO WORLDS COLLIDE: WHEN CARTOONS AND LIVE-ACTION MEET

After a long period in which the audience for feature-length cartoons had gradually dwindled, global interest in hand-drawn animation was reignited in 1988 by Robert Zemeckis's groundbreaking *Who Framed Roger Rabbit*, a film that dared to introduce a style of cinematography never previously attempted in the combination of live-action and cartoons. Movies like *Mary Poppins* (1964) and *Bedknobs and Broomsticks* (1971) had included specific short sequences in which live performers interacted with animated characters, but in *Who Framed Roger Rabbit*, the humans and the Toons shared the screen in almost every scene.



Thirty years before *Mary Poppins* and sixty years ahead of *Who Framed Roger Rabbit*, the Fleischer brothers succeeded in combining cartoon and live-action elements to great cinematic effect.

Who Framed Roger Rabbit
Director: Robert Zemeckis
Production: Touchstone Pictures
Distributed by: MCA Home Video

With the tools and techniques available in the '60s and '70s, an acceptable illusion of real and imaginary characters "sharing the stage" could only be achieved if the movement of the camera was severely restricted. For flat artwork to share screen space with solid objects in a believable way, the lighting also had to be adjusted to "flatten" the appearance of the human figures and physical props. On *Roger Rabbit*, however, Animation Director Richard Williams encouraged Zemeckis to be just as ambitious with the cinematography as he would have been on a regular live-action shoot.

As Layout Supervisor Roy Naisbitt recalls:

The camera moving in and out and around was a Zemeckis trademark—he did that more than anybody else at the time. But before filming, Zemeckis suggested that he only move the camera up and down because he knew it was difficult to animate if the camera went in and out. Dick said that Zemeckis should shoot his film as he would for live-action and, difficult though it may be, the animators would animate accordingly.

Having been fortunate enough to land my own first animation job as an inbetweener and assistant animator in the Special Effects Department on *Roger Rabbit* in London, I acquired a good working knowledge of the exposure sheets and camera guides that charted and governed the creation and photography of both character and effects elements in traditional animation. But I had little or no contact with either layout or background artists because, with the exception of the introductory "Maroon Cartoon," *Somethin's Cookin*, and one lone sequence animated in the United States, *Roger Rabbit* involved no hand-painted "cartoon" background artwork of any kind.

Moving in the mid-1990s from hand-drawn special effects into the expanding field of animation



The hand-drawn special effects elements alone took more than three weeks to animate, assist and inbetween in this scene where Eddie Valiant (Bob Hoskins) hides Roger in the sink with his laundry.

Illustration by Steve Meyers
 Animation by Steve Meyers
 Animation by Kevin Williams
 Animation by Kevin Williams
 Animation by Kevin Williams

software had brought me no closer to any real understanding of the principles of layout. It was only when I was hired again by Disney in 1997 to work as artistic coordinator on *Tarzan* that I found myself, for the very first time, in a layout approvals session. I took one look at what was happening around me and thought to myself, “Well, what do you know? *These* are the guys who actually *make* the movie!” With the profusion of character poses, background layouts, and camera guides now passing through my hands, a much broader horizon opened up in front of me against which the X-sheets (exposure sheets) began to look like a combination of master plan and air traffic control—which, in effect, is exactly what they are.

My role as artistic coordinator on *Tarzan* gave me a free pass to enter every corner of the animation pipeline and finally to fill in some of the worryingly large gaps in my own existing knowledge of the machinery of production. From the newly discovered vantage point of the Layout Department, I found a whole new production vista opening up around me. Daily (sometimes hourly) visits to the Scene Planning Department added to the complex, impressive, and highly efficient picture that was emerging, of a process in which the vital dynamic between the bigger and smaller “pictures” in Disney’s multidepartmental production process began to take shape.

Listening in to discussions between the directors, art directors, and layout supervisor in the biweekly layout meetings, I finally cottoned on to the process by which, for example, scene lengths were arrived at. Pretty fundamental stuff—but all something of a surprise to me. When I’d been an effects animator, scene artwork simply arrived on my desk; I would add the required components and then watch as the levels disappeared ‘round the corner to be inked and traced, only to be replaced by another incoming pile. Who was to say why any individual scene might have been a particular length?

“MALES EFFECT TO RIGHT”

TOP

- A Rough story panel.
- B Still frame showing metal pipe for water spray.
- C Character line artwork over photostat of movie frame.
- D Painted character cel.

CENTER

- A “Flop” (or back-lit) image of opaqued character cel
- B Color composite minus articulate mate for linger/neck registration

- C Effects matte showing shading for Roger (in white).
- D Effects contact shadow for Hoskins’ shirt (in white).

BOTTOM

- A Articulate matte to register fingers to character’s neck.
- B Character “flop” silhouette cropped by finger registration matte.
- C Effects level for shading shown at a percentage of full opacity, registration matte shown in black.
- D Monochrome version of final composite image.



And this, in effect, is one of the reasons why so many people, particularly those working busily *within* the industry itself, have been able to develop the same, very limited view of the production landscape that I myself still held after nearly ten years of working in the medium. Because animation is so relentlessly labor intensive and often has to be produced under high-pressure deadlines, individual artists can all too easily become so absorbed in the demands of their own specialist skill-set that knowledge of the other departments, apart from those that immediately precede or follow their own, remains sketchy.

One might even argue that layout in particular remains mysterious to so many of the artists and technicians who work in the neighboring departments because it is, in effect, the medium within which all the other disciplines operate, the

backdrop (quite literally) against which the drama of the movie is played out. By contrast to their colleagues, layout artists usually have a broad and enviable grasp of pretty much every technique and process that making an animated movie involves. Of all the hand-drawn animated movies that Disney had produced up until that point, *Tarzan* was of particular importance for one other very notable reason: it was the first film of its kind to accomplish a seamless blend of hand-drawn “flat” character artwork with computer-modeled (but hand-painted) 3D environments. Deep Canvas, the groundbreaking software process developed for the movie by Disney’s own in-house CGI (computer-generated imagery) team, deservedly went on to win an Academy Award™ for Technical Achievement. Comparable toolkits, developed by leading commercial software companies, quickly

LEFT: The Academy Award™-winning Deep Canvas software package allowed many of the environments in Disney's *Tarzan* (1999) to be modeled in 3D even though the character animation was entirely hand-drawn; this greatly expanded the possibilities for camera movement, allowing full 360-degree rotation (about any axis) within a virtual, computer-modeled environment.

Rough character animation key of *Tarzan* by Glen Keane over 'Deep Canvas' layout by Johan Klinger. First animation test.

Tarzan (1999)

Directed by Kevin Lima and Chris Buck



became familiar features in off-the-shelf painting and modeling packages.

Immersed as so many of us presently are in the *x, y, z* axes of the virtual 3-dimensional world that's now so readily available inside our computers, it's easy to lose touch (literally) with the tangible mechanical components upon which the moviemaking process originally depended and from which much of our present-day digital toolkit is derived. And this loss of contact is not peculiar to the world of computer-generated 3D animation. At the time of writing, most "traditional" hand-drawn animation artwork no longer passes beneath a traditional camera lens, a departure from the way in which animated scenes were captured on film for decades. The CAPS system,² another Academy Award winner for Disney, led the field in both digital ink and paint and computerized image compositing, processes whereby character line artwork, though still drawn on

sheets of paper, could be scanned and digitized so that it might then be colored, positioned, and "photographed" over hand-painted background artwork (which has itself been scanned and digitized in exactly the same way) within the infinite "space" made available by this same virtual movie-making realm.

As computer memory became cheaper and processing speeds picked up, it became easier to manipulate multiple digital image components simultaneously in something approaching real time. This meant that many of the optical processes that previously could only have been accomplished by the Camera Department and the laboratory in postproduction have now moved to the front end of the pipeline. Consequently, the entire film editing process (with which the work of the layout crew is also closely interwoven) has been revised to the point where story reels, once crude assemblies of rough sketch artwork and

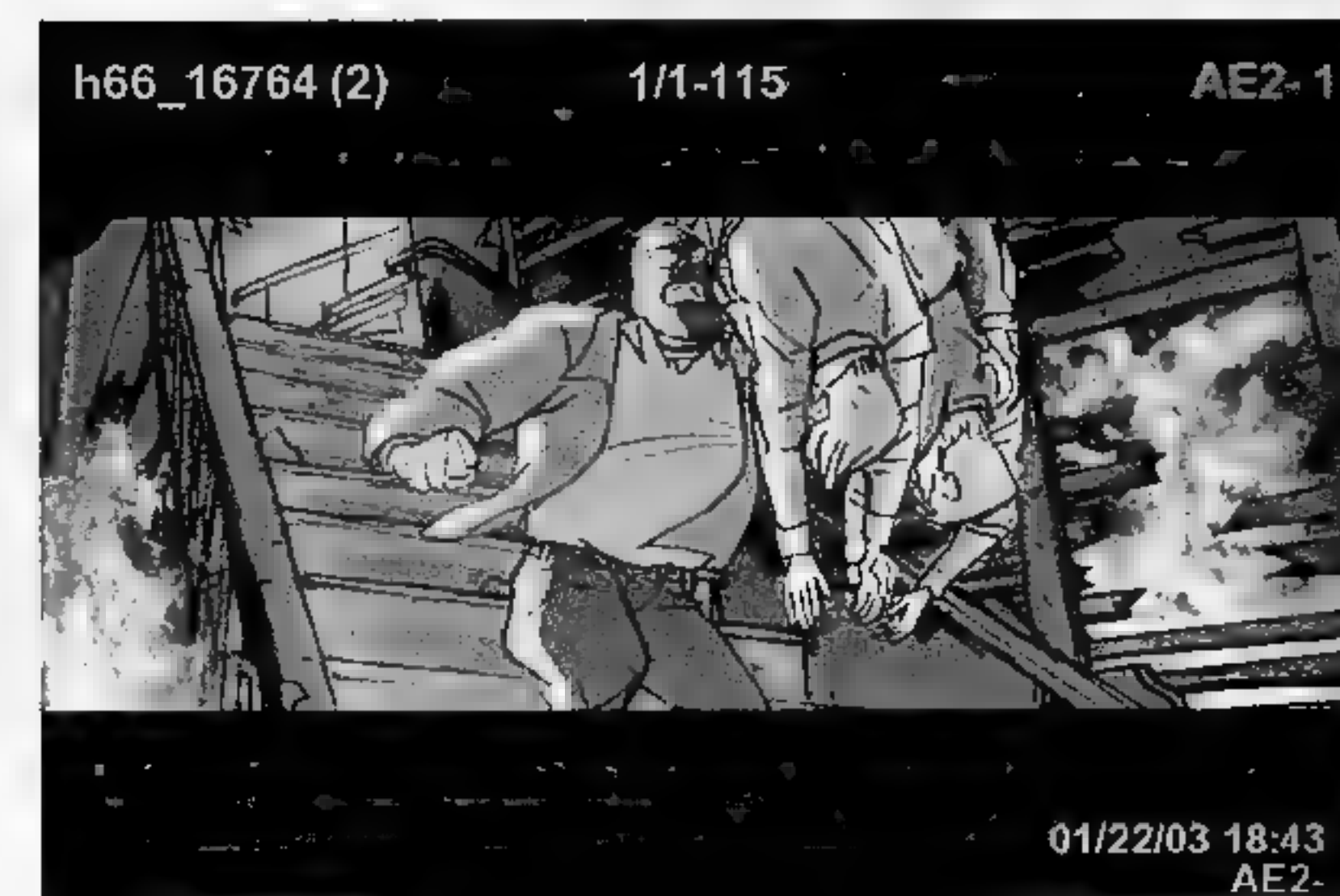
RIGHT: "Virtual" cameras and digital image manipulation software have allowed the story reel to evolve into the more sophisticated "animatic" (see chapter 7).

The Incredibles (2004)

Directed by Brad Bird and edited by Stephen Schaffer

Animatic by Andrew Jimenez

Head of Story: Mark Andrews



"scratch" dialogue, are now impressively polished (see chapter 7). Mark Andrews, former head of story and now a director at Pixar, described to me how he and Andy Jimenez had taken full advantage of this new approach on *The Incredibles*:

The first time we showed the first two acts of reels everybody came out of there going, "We could release this!" because it was that detailed.

Advances in technology have, of course, been the lifeblood of cinema since the earliest times. In that sense it's an industry that has never kept still. But the kind of rapid change to which so many of us have become accustomed as one computer innovation has followed close on the heels of the last can easily muddy the water, creating enormous confusion for those already working in the industry and rendering certain production processes hopelessly opaque to the novice or the student.

© Legendary Academy and BAFTA Award-winning live-action cinematographer Jack Cardiff BSC, ASC at work.

© Disney Animation Studios

© Disney Animation Studios

A primary aim in researching and writing this book has been to try to close a curious gap that I noticed on the bookshelf when I first began trying to answer students' questions about the technique and history of animation layout. From the moment I began inquiring among friends and colleagues in the industry, it became clear that some kind of attempt at a comprehensive explanation of the history and development of layout would be very welcome, not least because a new generation of animation artists was emerging for whom the language and terminology of hand-drawn layout were becoming, by turns, familiar and perplexing.

Anybody accepting a junior position at a CGI animation studio and then taking an inquisitive look at the credits for *Pinocchio* or *What's Opera, Doc?* could be forgiven for wondering what "layout" meant back in the days when names like Thor Putnam, Ken O'Connor, and Maurice Noble were regularly to be found in the design and layout credits on the cinema screen. Some younger animation recruits may soon even have bypassed the cinema altogether, encountering movie animation solely via television or the Internet.

So a parallel agenda may become clear along the way: namely, my own modest campaign to give some kind of clear identity, some kind of recognition to a department that, as many layout artists have remarked to me, tends to remain invisible to audience and industry alike, in spite of being so indispensable.

As more and more of the physical apparatus of moviemaking vanishes from the physical space around us, only to reappear in virtual form inside the computer, some of the apparent technological luxuries become traps. Developments that may seem convenient at first can become both practically and creatively dangerous. After all, if we don't fully understand the optical properties of physical lenses, how can we make informed and

appropriate choices, faced with a lengthy pull-down menu of virtual lenses?

THE LENS AND THE PAGE

"Layout is the cinematography of animation, layout is the blueprint of animation."

Rasoul Azadani, traditional and digital layout supervisor,
Walt Disney Animation Studios

Imagine you're a camera operator. Eagerly you look forward to discovering stunning locations with the director of photography and exploring them through different lenses. Maybe there will be dazzling studio sets for the camera crew to capture on film? Perhaps the budget will allow you to lay elaborate tracks for the camera dolly to roll along, or to hire a crane so you can soar above the actors and extras as they reenact a New York rush hour or a nineteenth-century ballroom scene.

Now I'd like you to imagine that you're a quite different kind of camera operator. Your camera is permanently trapped in a darkened room where it sits above a table that's been tightly fastened to the floor. Often only one lens is available to you and, though you have lights to work with, everything they illuminate must be completely flat.

Worst of all, instead of being able to move your camera freely through a real landscape, endless sheets of paper and plastic have to be positioned (and repositioned) on the table beneath your lens to create a complex and delicate illusion that you will then photograph laboriously frame by frame, sometimes taking several days just to complete one scene.

There's an obvious, even romantic appeal to the first notion and very little about the second that suggests anything other than drudgery. But if, last of all, you imagine that, in spite of all the crazy limitations, the images captured in that darkened



In the 1920s areas of the background were often deliberately left blank so that the character performance could be “read” more clearly by the audience.

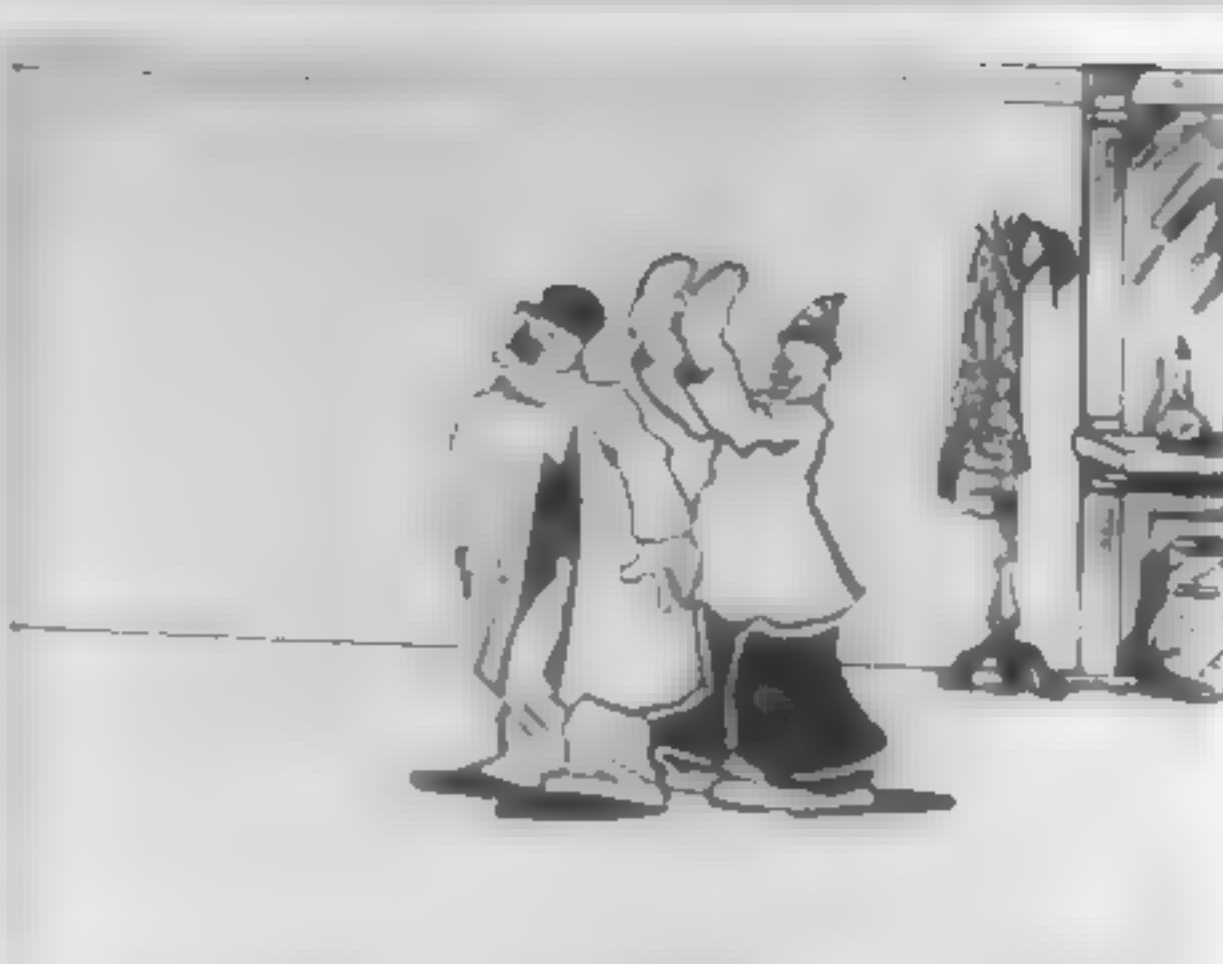
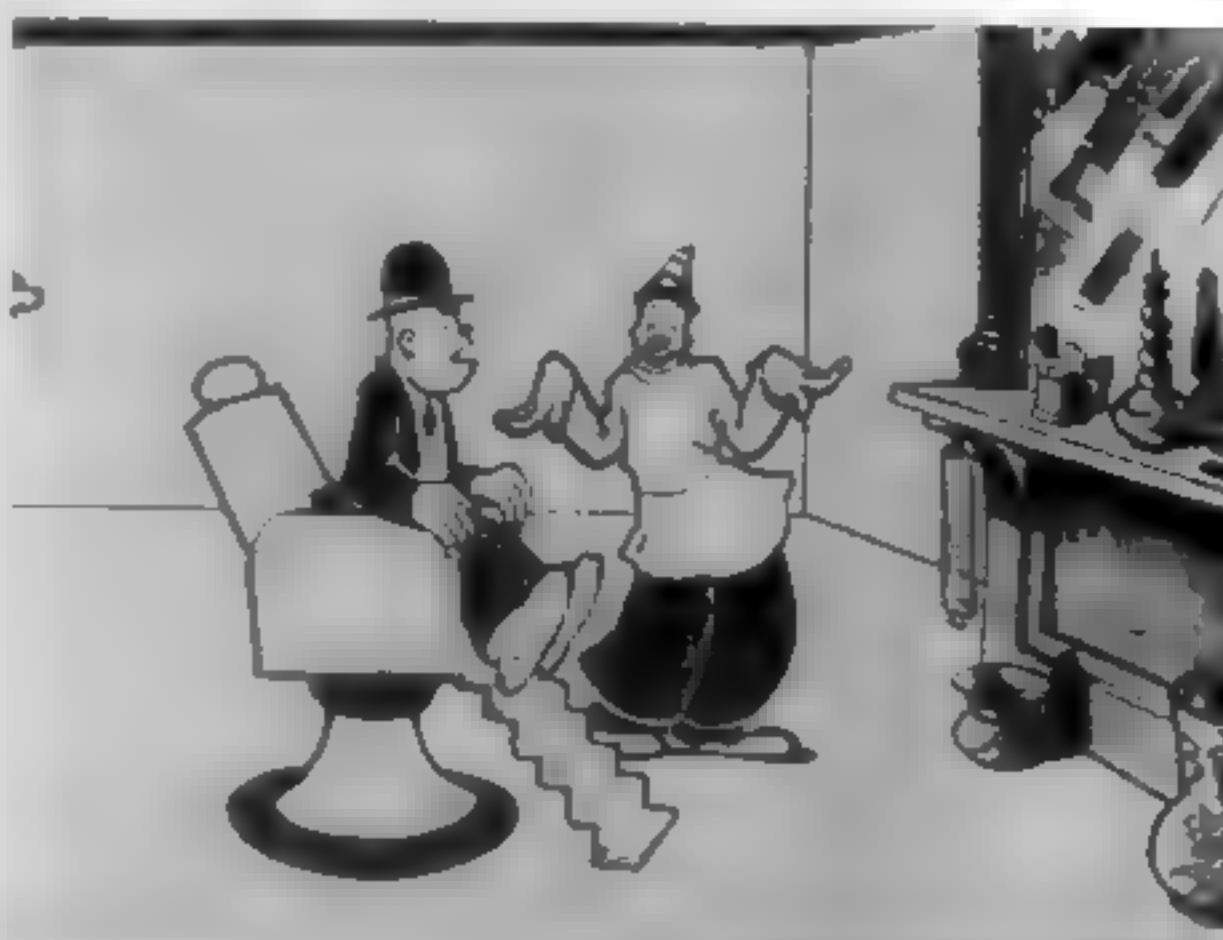
TOPLEFT *Ko-Ko Baffles the Bulls* (1926)

CENTERLEFT *Big Chief Ko-Ko* (1924)

BOTTOMLEFT *Ko-Ko Nuts* (1925)

RIGHT-HAND COLUMN *Ko-Ko the Barber* (1924)

All Directed by Dave Fleischer & Produced by Max Fleischer



room by that one solitary lens combine to create a moving picture that not only outruns almost all of its live-action competitors at the box office, it outlives most of them in the popular imagination and goes on to influence the cinematographers of the next century, perhaps all that lonely repetitive labor begins to seem justified.

In the years preceding Disney's *Snow White and the Seven Dwarfs*, and many times since, animation with far more modest creative and technical ambitions has succeeded in telling stories and winning audiences; this book aims to examine the layout designs and techniques of many different studios and eras. But cinema changed dramatically in 1937 with the release of Disney's first feature-length animated movie, as did the visual language and imaginative appetite of a global audience.

With *Snow White's* global success, the popular notion of cinematography ought to have changed as well but, while many admired what Disney's magnificent team of artists and technicians had accomplished, there was no great rush of budding competitors, eager to duplicate their achievement. With the notable exception of brothers Max and Dave Fleischer, who developed beyond the production of their popular *Out of the Inkwell* series to produce two feature-length cartoons, *Gulliver's Travels* (1939) and *Mr. Bug Goes to Town* (1941), few even dared to make the attempt. And yet conventional cinema had spread like wildfire—so what on earth was holding everybody back?

Today, most laptop computers are equipped with all kinds of user-friendly moviemaking software, and animation techniques can be freely communicated over the Internet. The contemporary movie-going public expects to find animated characters, images, and graphics moving around on an endlessly expanding range of luminous screens, some fitting easily into the pocket, others the size of a

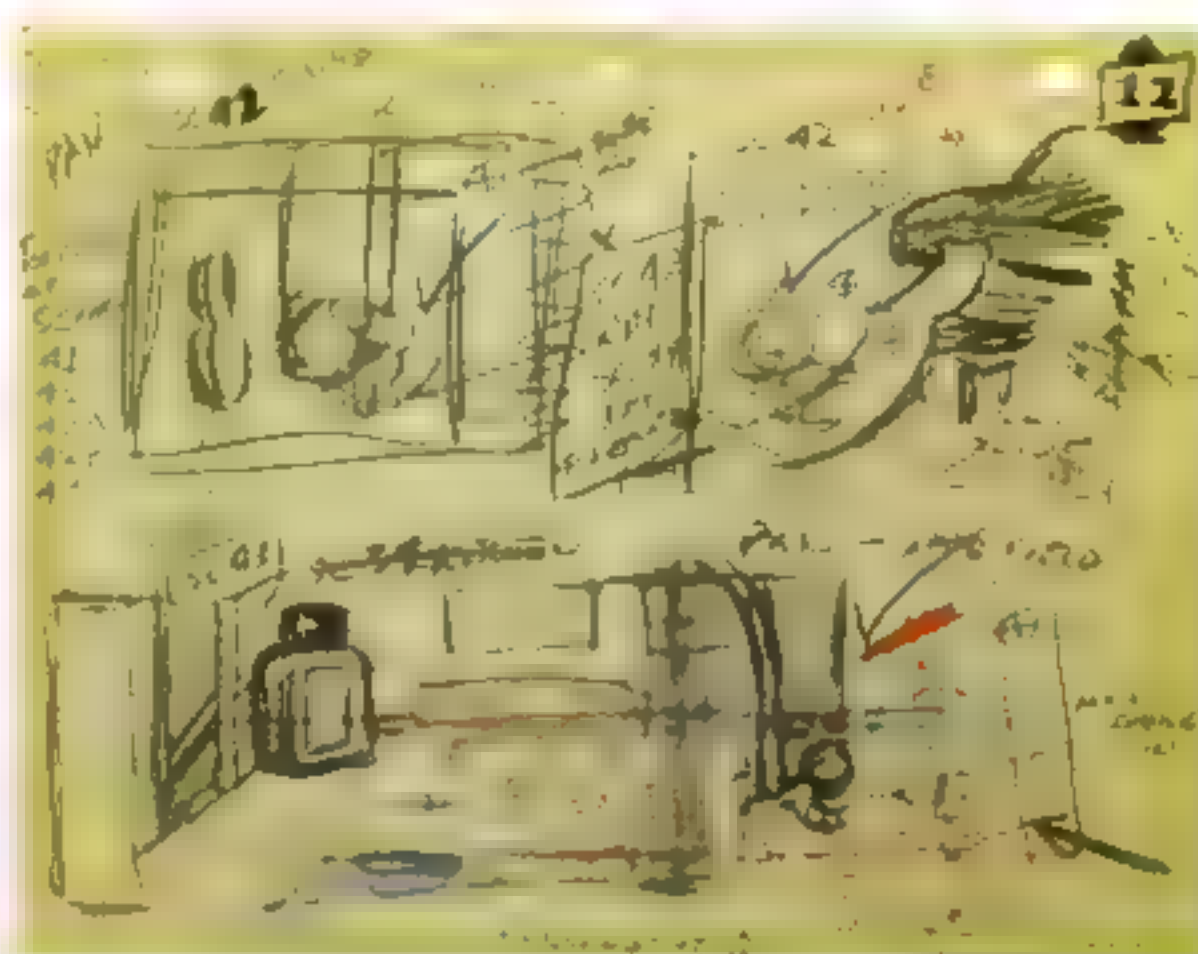
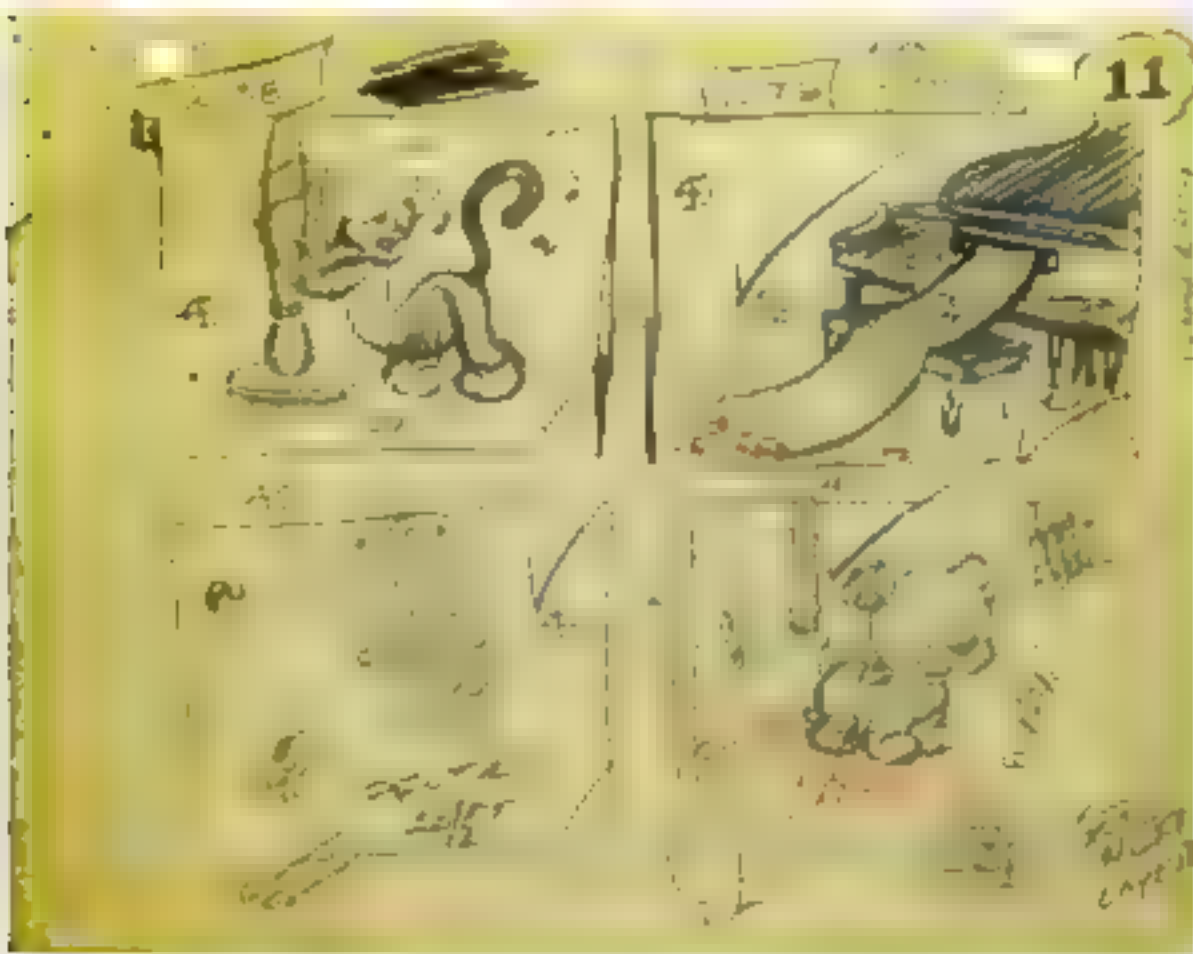
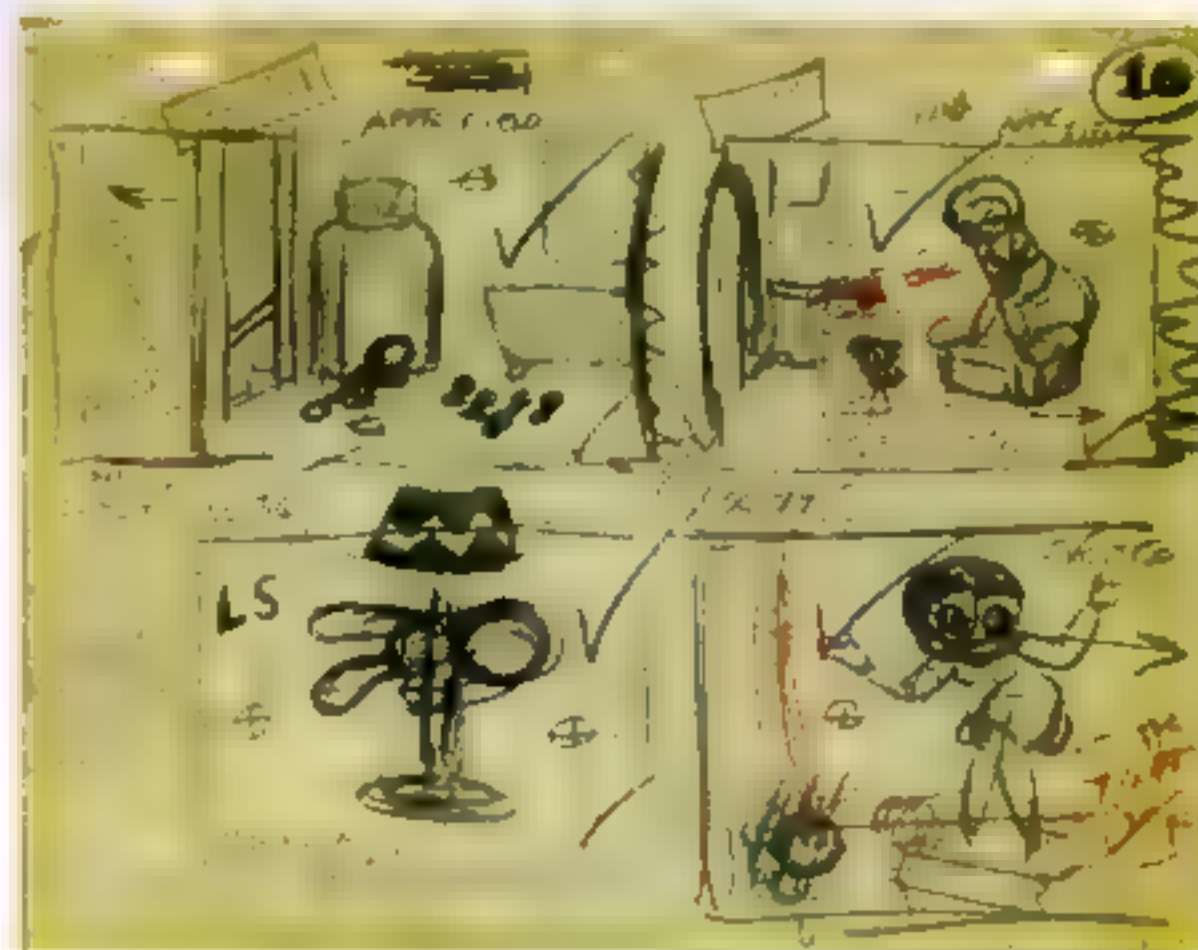
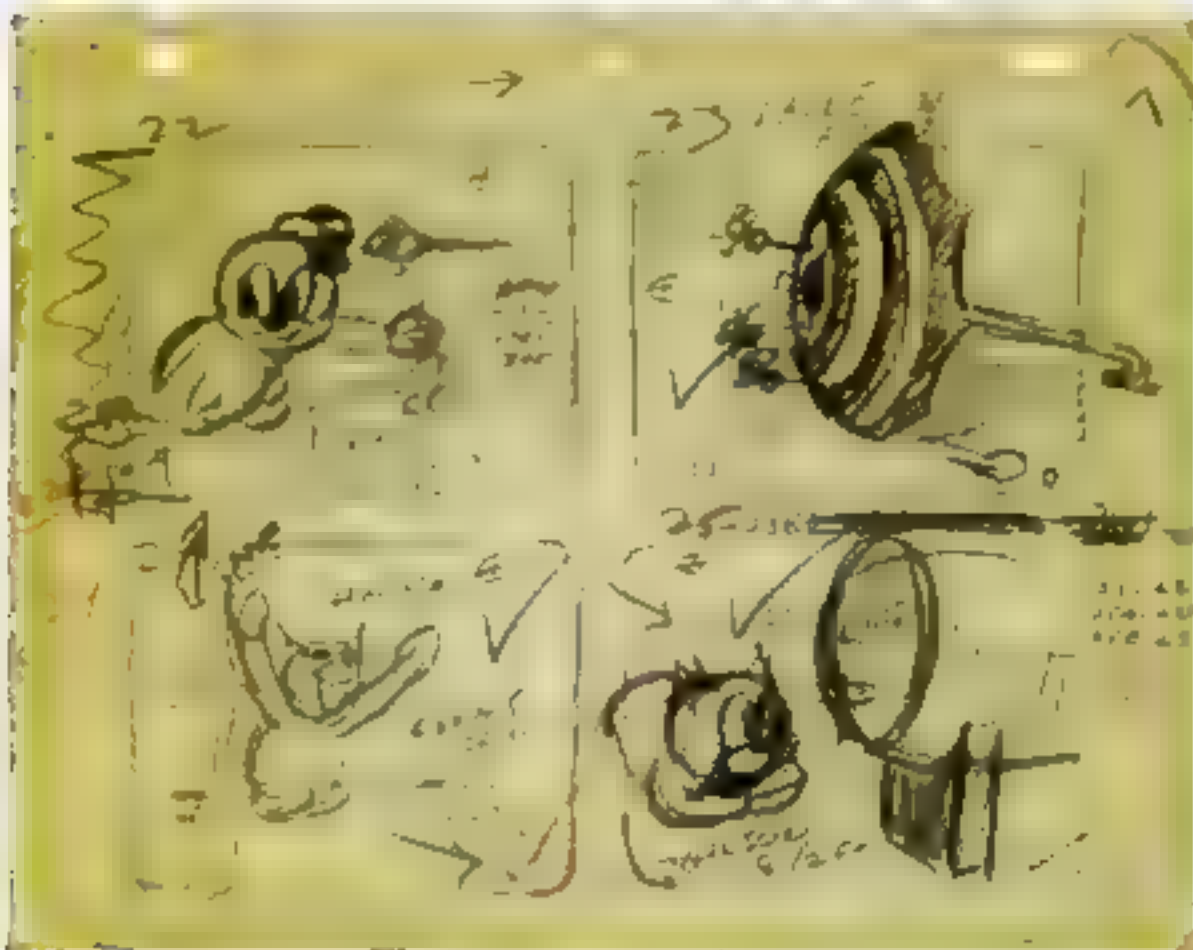
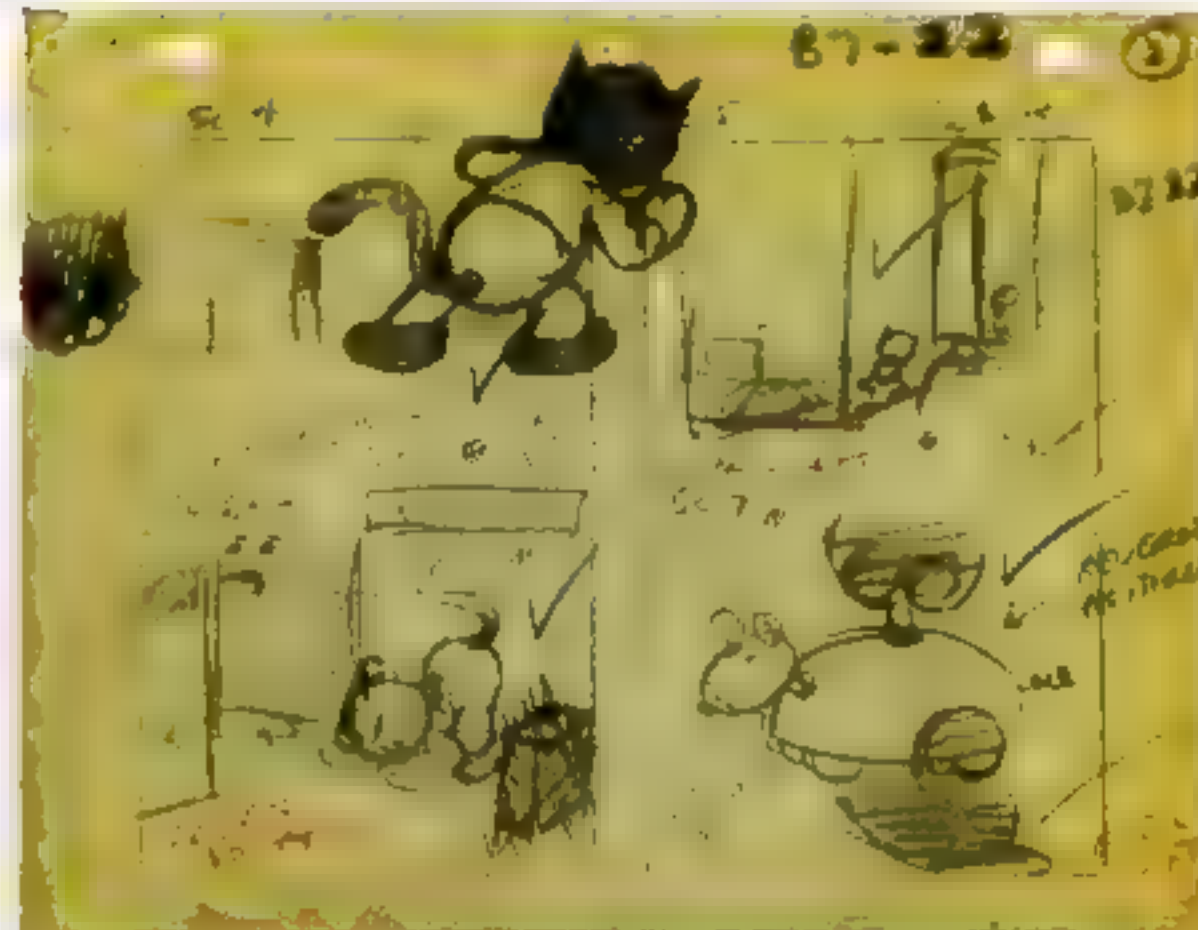
The performances of the characters, the movements of the artwork beneath the camera lens, the footage for each scene and the workloads of the individual animators were all plotted out on animation paper for this 1938 *Betty Boop* short.

Pudgy the Watchman (1938)

Directed by Dave Fleischer

Produced by Max Fleischer

Lead Animators: Thomas Johnson and Harold Walker



skyscraper. However, the toolkit and skills required to make anything other than short-format animated films remained so peculiar and so specific for such a long time that nearly sixty years passed before anything fit to be called an “industry” developed in fully animated feature films. The seed planted by *Snow White* has taken a very long time to germinate, let alone sprout any recognizable number of shoots.

Among mainstream cinema artists and technicians of the time, procedures could be standardized and awards could be handed out, but for all the respect it might have received in the industry, it's easy to see how the idea of animation “cinematography” might have been a difficult one for the population at large to grasp when only one studio was regularly producing feature-length animation. When we think of motion picture photography today we still tend to think of movie cameras pointing out at the world, not in at the furniture. And whereas the job descriptions in live-action imply involvement in the creation of the image (director of photography, lighting cameraperson), we're left wondering exactly who the “cinematographer” is on a movie like *Pinocchio*. Is it the person who points the camera at the artwork or is it the person who creates the artwork? And when such a variety of different component parts has to be created by such a wide range of different artists, each charged with producing different pieces of an elaborate moving puzzle, on whose head should the title “cinematographer” settle?

Compared with the more easily identifiable lone figure of the live-action production designer supervising the construction of a complicated set, or the live-action camera operator poised at the tripod with one eye pressed to the viewfinder, even the head of an Animation Layout Department would be hard to imagine or depict in any one role or in any single identifiable pose.

The path of action for an approaching twister is carefully worked out in this rough sketch, along with a clear plan for the position and movement of the camera and various suggested bits of comedy “business” as the storm sweeps the landscape.

The Band Concert (1935)

Directed by Willfred Jackson

Not only is the division of labor on an animated movie complicated and changeable, entire parts of the process, like sound and editing, are effectively mirror images of their live-action counterparts, appearing at the beginning, rather than the end, of the production pipeline. In addition, few of the original hands-on techniques and processes have survived into the digital age, making it harder still to arrive at any one description of the layout process that encompasses the full variety of different production contexts into which a layout crew must fit.

Of course, all cinematography is the result of a team effort. On a live-action set lights need to be hoisted into place and connected up to the power supply, the camera itself has to be mounted on tripods, dollies, and booms. Actors don’t photograph well without makeup, and sets and performers alike have to be dressed. Once exposed, the film has to be processed in the laboratory, then synchronized with the soundtrack and spliced together in the cutting room where decisions will be made about additional effects such as wipes, dissolves, and multiple exposures.

Animation cinematography is, and always has been, the result of a close working partnership between the artists who design and create the various artwork elements and the technicians and craftspeople who design and operate the complex camera setups, whether real or virtual, through which that artwork eventually becomes a living and luminous screen image. The layout crew must, at some stage or another, feed and respond to the needs of every department in the animation pipeline.

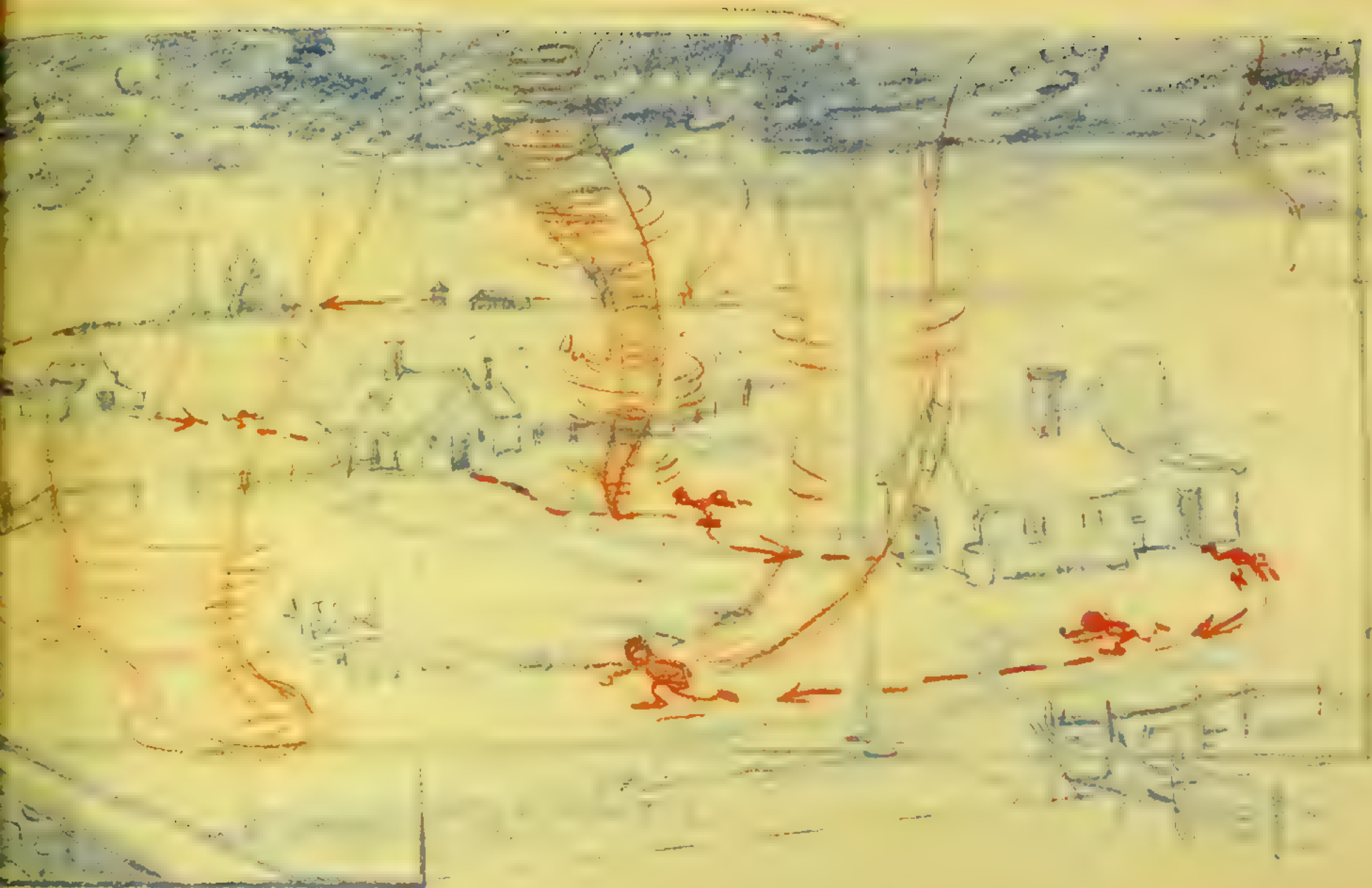
Endnotes

1. See glossary.

2. See glossary.



START

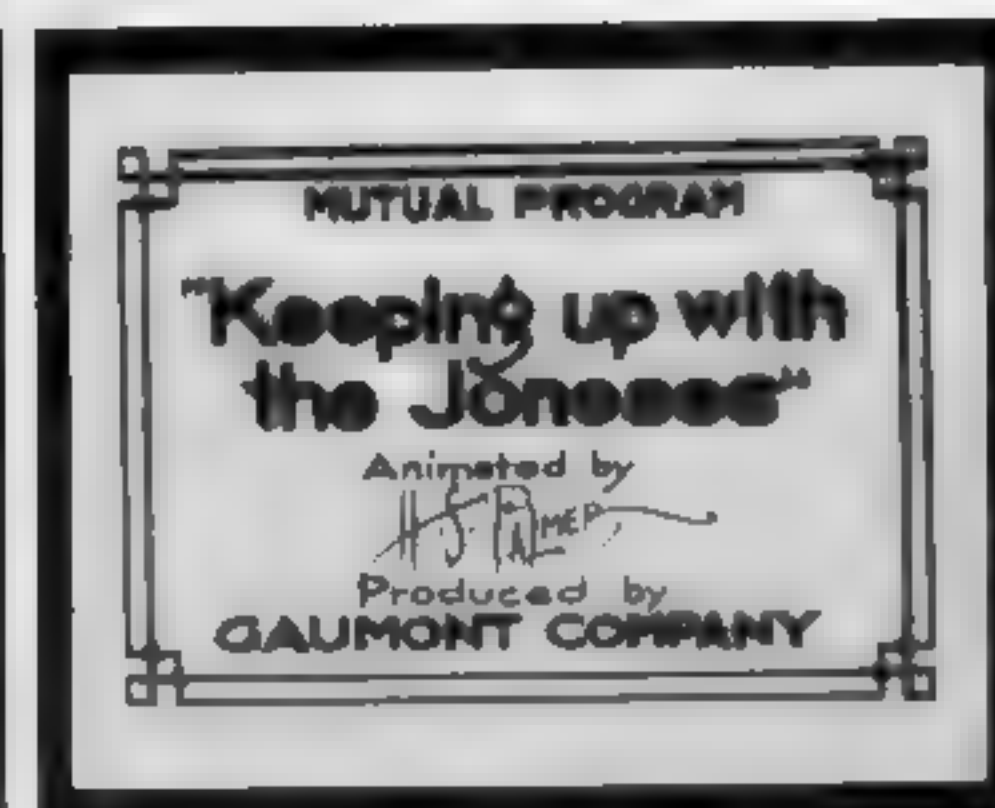
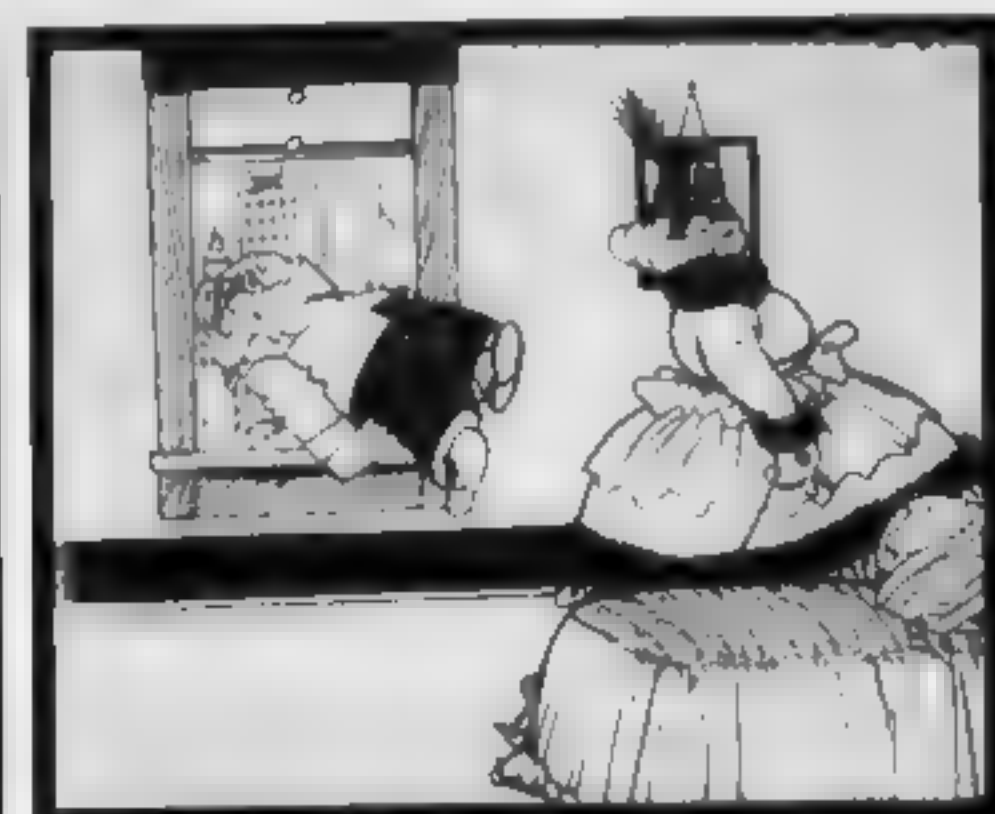
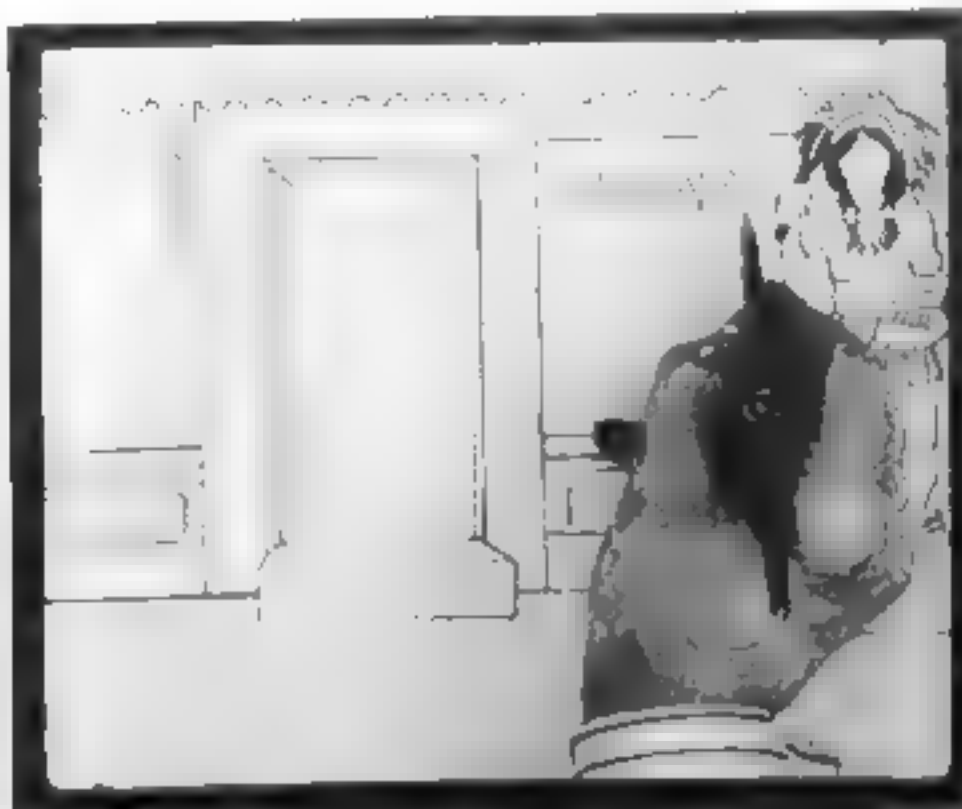


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TOP ROW Speeded-up film of the artist's hand is shown in the second image as he draws in the outlines of a storefront; both the third and fourth images show how paper cutouts and vignettes were used as a simple means of "layering" character and scenic elements. Frame enlargements from *Women's Styles* (1915), part of the *Keeping Up With the Joneses* series produced by the Gaumont Company, animated by Harry S. Palmer

CENTER ROW A midshot, a point-of-view shot, and a close-up show how the developing "language" of cinematography and film editing was being exploited by animators in the early years of the twentieth century. Frame enlargements from *Men's Styles* (1915), part of the *Keeping Up With the Joneses* series produced by the Gaumont Company, animated by Harry S. Palmer

BOTTOM ROW By the 1920s, with character animation drawings traced and painted onto separate cels, and with improvements in the quality of the light-sensitive emulsions used in the manufacture of film stock, individual backgrounds could safely include greater tonal variation and a higher degree of detail. Frame enlargements from *Dud Leaves Home*, part of the *Us Fellers* series (1919), Bray Pictures Corporation. Written and animated by Wallace Carlson



BUON

BLANCHISSERIE



During the 19th century, children who were lucky enough to own a cardboard toy theater could choose between buying scenic artwork that had already been over-printed in color or, for a penny less, buying the outline version and then coloring it by hand. Here we see one publisher's "plain" version of the backdrop from a climactic scene of a burning mill, set alongside both the "penny plain" and "tuppence coloured" versions of the matching side flats.

Illustration: Webb's Scenes in the Miller and His Men, No. 29, 1840s. London: Webb's Toy Theatres, 1840s. (Image courtesy of the British Library)

Just as contemporary computer games are often derived from (or go on to inspire) popular movie franchises, the publishers of children's toy theaters would send artists to the most popular stage productions to make notes about the plot and sketches of the performers and stage sets. Children could then reenact famous performances in miniature on a tabletop at home.

Illustration: Pollock's Scenes in the Miller and His Men, No. 11, 1840s. London: Pollock's Toy Theatres, 1840s. (Image courtesy of the British Library)

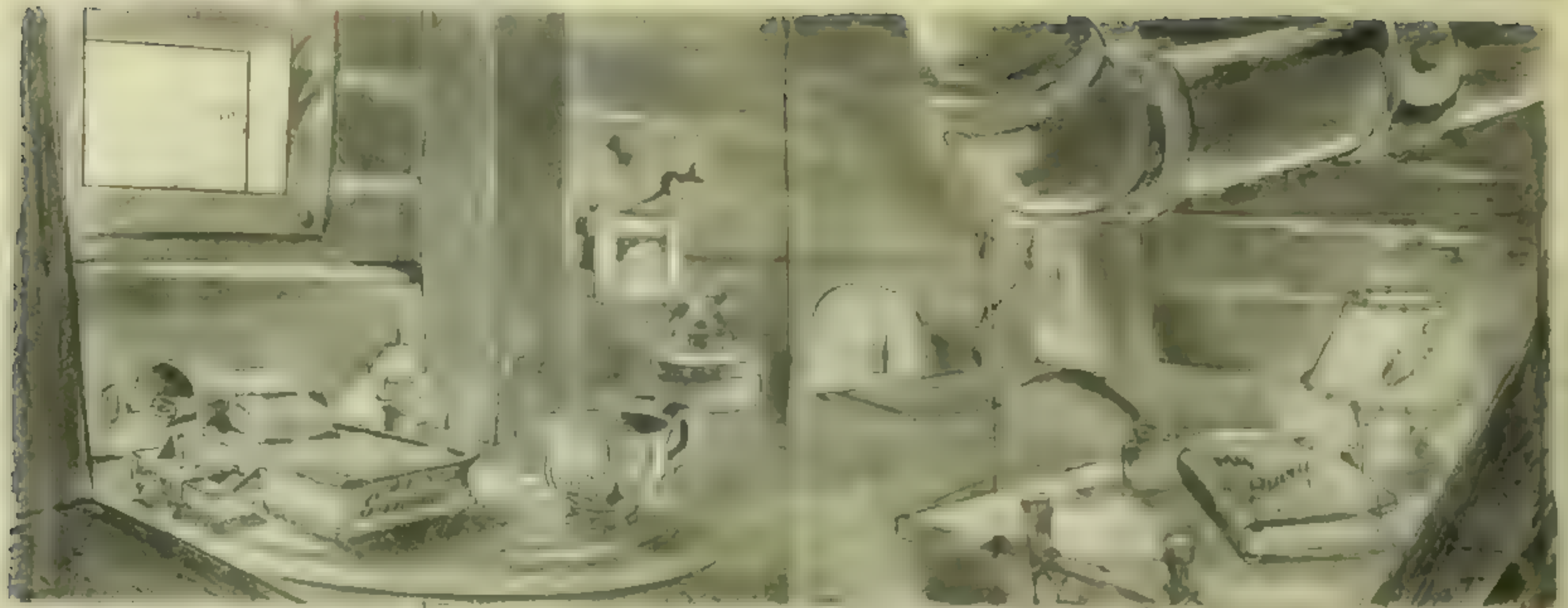


This background painting is designed to be photographed on side pegs, with the artwork being moved "vertically," frame by frame, on the compound table beneath the rostrum camera lens to create the equivalent of a live-action downward "tilt."

1. The background painting is designed to be photographed on side pegs, with the artwork being moved "vertically," frame by frame, on the compound table beneath the rostrum camera lens to create the equivalent of a live-action downward "tilt."



Original pencil layout overlaid with frame enlargement



2

**FROM
THE PAGE**

**TO THE
SCREEN**

DRAWING
PAPER

DRAWING
PAPER

As will already be apparent, there is more than one art involved in layout. And there is more than one art involved in layout because there is more than one kind of movement involved in animation.

As in live-action moviemaking, the performers in animation have to move in order to emote and communicate, but the camera must also move (or appear to move) from time to time in order to follow the action or to hint at the relationships, motivations, and possible fate of the characters. Even if every shot in a sequence is captured from a locked-off camera position, the process of cutting from one viewpoint to another when the footage is edited introduces yet another kind of movement: the movement of visual continuity that underpins all cinematic and televisual narrative.

While many may feel, even today, that the *real* miracle and wonder of animation is to be found in the movement of the characters, every element within the frame of an animated film has to be carefully designed in order to survive the many changes in composition and staging that are caused by camera movement, character performance, and picture editing. To better understand how such a complex working relationship between art and technology ever developed into a viable industry, let's return to our dictionary derivation of photography and remind ourselves how and why it was that people first began "drawing with light."

CHARACTERS AND BACKGROUNDS: FROM MUYBRIDGE TO MCCAY

The central miracle of still photography had been the speed at which a true-to-life image could be captured. But no matter how quickly individual images from the 3-dimensional world could be focused through a lens and burned into the light-sensitive emulsion on a single photographic plate, the camera itself remained as powerless as the human eye when it came to capturing anything other than a stationary image.

Point your lens at a mountain range and every detail of the rocks and trees would register while water, unless frozen stiff in winter, would become an eerie brushstroke of polished smoke. Aim your camera at a crowded street and the hurriedly moving people would register as a ghostly cloud, smeared impatiently across the immobile precision of the architecture behind them.

So perhaps Muybridge is partly to blame for the preoccupation with character animation, which, a century into the development of the medium of animation, still seems to dominate everything from our college curricula to industry awards ceremonies. Though famous as a prolific and accomplished photographer of landscapes, when Muybridge embarked on his celebrated photographic studies of animal and human locomotion at the University of Pennsylvania in 1884, he was encouraged by the commission appointed to oversee his work to cancel out the natural environment completely, concealing it with a series of rigid mathematical grids against which the movements of the figures could more easily be studied and calibrated.

The historical neglect of layout and background design may also be an extension of the popular identification with the "figure in the spotlight." It's easy, after all, to understand why a classical musician might aspire to be a soloist rather than an orchestral player, and most of us have dreamed, at one time or another, of being the top-billed actor in a movie or the lead singer in a band. Indeed it's one of the persistent contradictions of show business that such a small number of talented people should become so familiar to us, thanks to the efforts of a large army of no less skilled, but largely anonymous, individuals.

No fan of the vain performer, theater critic Alexander Woollcott is said to have written in one particularly unkind review that "The scenery in the play was beautiful, but the actors got in front of it." With more than twenty years of experience in the Layout Department at Walt Disney Animation in Burbank, Rasoul Azadani knows better than most how important it is for scenic design to make its impact at the unconscious level:

I tell my layout team, "If you come out of the movie and somebody says, 'That was a great background!' – you've failed. The audience shouldn't be looking at the backgrounds, they should be looking at the character."

This in itself doesn't mean that we can suspend our disbelief for long if we're faced with figures floating in an otherwise blank environment; that too can become distracting. If an audience recognizes that something as fundamental as the character's own world, whether real or imaginary, is missing from the picture, the theatrical illusion is broken.

Muybridge's studies of movement were, of course, designed to analyze and inform rather than to entertain. But as human beings we have a

PREVIOUS: A scene staged by Winsor McCay for *Little Nemo* (1911) showing enormous parcels of paper and entire barrels of ink being delivered to his studio to allow him to create "four thousand pen drawings that will move."



TOP, LEFT: The long exposure time for this image means that only the seated figures in the doorway are clearly visible while the passersby register as a "ghost" image, a faint cloud above the sidewalk. Grassmarket, Edinburgh, circa 1860. Albumen print, 25.60 x 21.00cm. Photograph by William Donaldson Clark



TOP, RIGHT: Alongside Norman Rockwell and Howard Pyle, Franklin Booth is one of Mark Andrews's favorite illustrators: "These guys told stories with the entire picture. It was as much about the background (as) what was happening with the character." Illustration by Franklin Booth (circa 19257). From *Franklin Booth, American Illustrator* by Manuel Auad

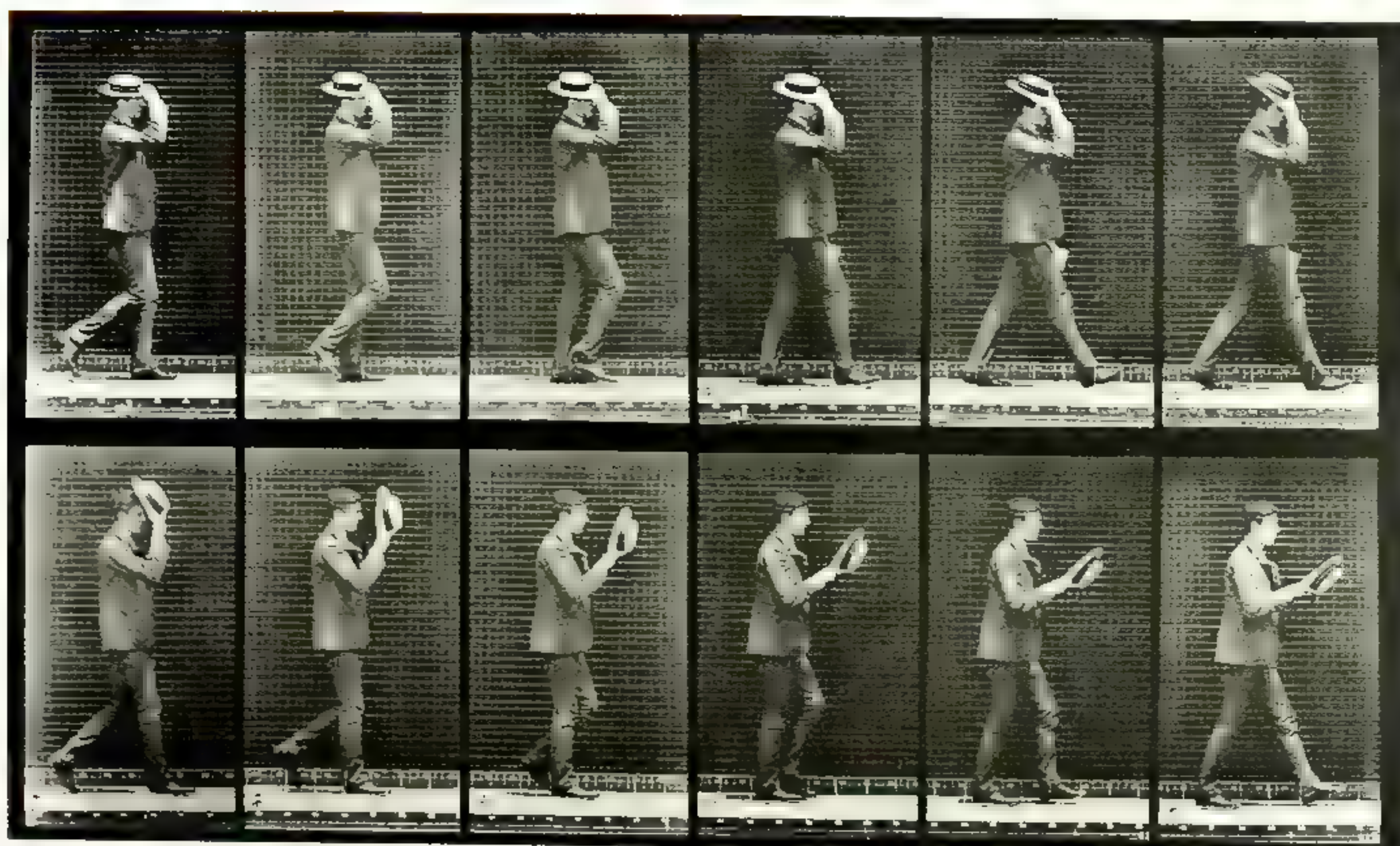
powerful need to make dramatic as well as rational sense of the images we see. We have a craving for narrative that cinema, more than any other visual art form, strives to satisfy, so it's not easy to look for long at the figures in Muybridge's motion studies without wondering who these people were. If only they could escape the ghostly grid and reenter some kind of recognizable landscape, how much easier it would be for us to see them not so much as random subjects of an ingenious experiment, but as sympathetic characters with stories worth discovering.

When I asked Mark Andrews of Pixar about animated characters and the worlds they inhabit, he told me:

I've been drawing my entire life, since I was three, and it was never just about the character, it was about the whole picture. That's always been my philosophy: you're not just looking at the characters; it's the setup, the environment that they're in. How can they react to that? How can light accentuate or support what's happening in the story? The visual elements, the set dressing, what moves, what doesn't. Are you following the action or is this locked off? All that stuff can help tell the story.

Remarking on the extraordinary skill of so many forgotten commercial illustrators of the nineteenth century, he went on to say:

I really admire the storytelling that came up through the illustrators from the 1800s to the early 1900s. I still look for those old illustrators. They were all superb draftsmen who could tell a story because in the newspapers, before cameras, they had to draw pictures to illustrate the news stories.



OPPOSITE, BOTTOM: The better to study and calibrate the movements of human figures and animals, pioneering photographer Eadweard Muybridge removed his subjects from their natural surroundings and placed them in front of a regular grid of numbered squares. Eadweard Muybridge: *Man walking and taking off a hat* Plate 44 (1887) (part of the *Animal Locomotion* series)

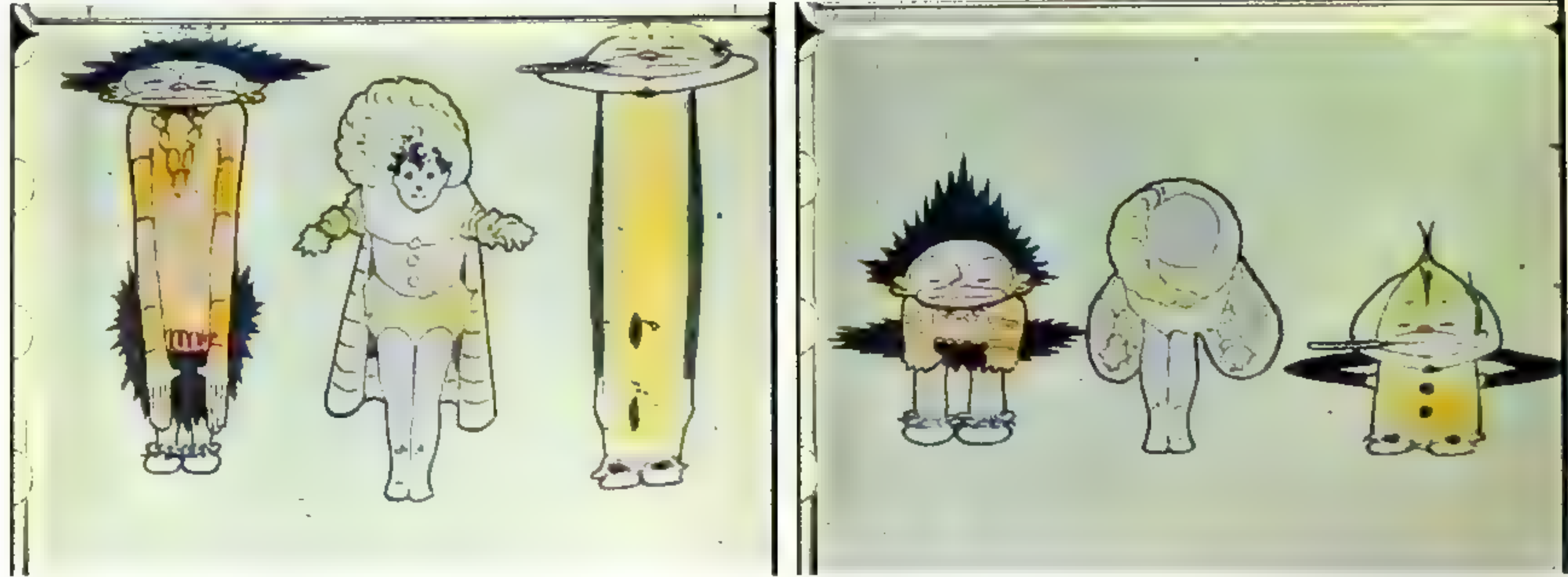
As with the early development of any art form, the pioneers of animation were very much at the mercy of the tools and materials available to them. Many, like Winsor McCay, were already seasoned commercial illustrators of the kind Andrews describes, accustomed to working within the confines of the print industry, which in the early years of the twentieth century had only recently embraced photography, through the development of the halftone printing process.

At the same time as that new technology had begun pushing the crafts of the engraver and the woodblock printer to the sidelines of the newspaper and publishing industries, improvements in the grain and light-sensitivity of photographic emulsions had begun to expand the tonal range of the images that could be captured accurately in a motion picture. Actors no longer had to use crude daubs of light and dark makeup to accentuate their facial features, turning them into the kind of caricature that the early sixteenth-of-a-second exposure required.

By the late 1920s, the accepted standard within the movie industry for camera and projector motor speed had begun to settle at 24 frames per second. However, the same high level of draftsmanship that might have served an artist well for the production (and industrial re-production) of a single image simply became part of the burden if a high-caliber illustrator like McCay reinvented himself as a moving picture cartoonist, thereby facing the challenge of producing hundreds—and sometimes thousands—of individually rendered images.

Initially, McCay, with the help of his young assistant John Fitzsimmons, turned the very intensity of all this new labor into part of the spectacle itself. In *Little Nemo* (1911), having enacted a barroom challenge in which he insists to his drinking buddies that he can create “four thousand pen drawings” in only a month, McCay then stages a sequence that

RIGHT: Three hand-animated figures distort against a blank background as though seen in a fairground Hall of Mirrors. *Little Nemo* (1911)
Animated and Directed by Winsor McCay



shows paper arriving in enormous boxes and ink being delivered in barrels to his studio to underscore the seemingly insane scale of his ambition. But for all its detail and mastery, the animated sequence which results from all this industry involves three figures who, for the most part, move and distort against an otherwise empty page.

I asked John Canemaker, author of the definitive biography of McCay and himself an Academy Award-winning animator, to put McCay’s approach in context:

Not only was he one of the great draftsmen of the modern era, McCay’s whole thrust was to communicate—and to communicate viscerally and physically as well as mentally and aesthetically. With *Gertie the Dinosaur*, McCay was also one of the first to create a multimedia presentation, so his thinking was very far advanced for the period.

The presentation to which Canemaker was referring first appeared in 1914, three years after *Little Nemo*. While other cartoonists were still busy moving simple character outlines around on blank pages or in awkward, sparsely furnished interiors, McCay had chosen to design, choreograph, and

star in an elaborate vaudeville act that would blend live performance with the projected image of a giant dinosaur, which he himself had animated and christened “Gertie.”

In what may be one of the earliest examples of the technique animators now refer to as “timing” a performance, McCay carefully planned Gertie’s movements to work as a sequence of reactions to commands he himself would deliver to the on-screen character, live, from the front of the theater stage. But as Canemaker pointed out:

Little Nemo hadn’t had elaborate backgrounds at all. The characters themselves were detailed but they were pretty much in limbo.

So rather than create an implausible creature hovering in white space, this time McCay drew a world for his character to inhabit, anchoring the projected image of Gertie in a rocky landscape the perspective of which was designed to be a believable match for the depth of the proscenium space that the audience knew to exist behind the screen.

McCay didn’t stop there. In under six minutes Gertie would complete her part of the performance “bargain” by swallowing one rock, throwing

TOP: Following a filmed introduction by Winsor McCay, Gertie emerges from her cave and proceeds to interact with various props and with the landscape itself as rendered on rice paper, one frame at a time, by McCay's assistant, John Fitzsimmons.

Gertie the Dinosaur (1914)

Animated and directed by Winsor McCay

BOTTOM, LEFT: The empty, ravaged landscape as it is left after Gertie's exit.

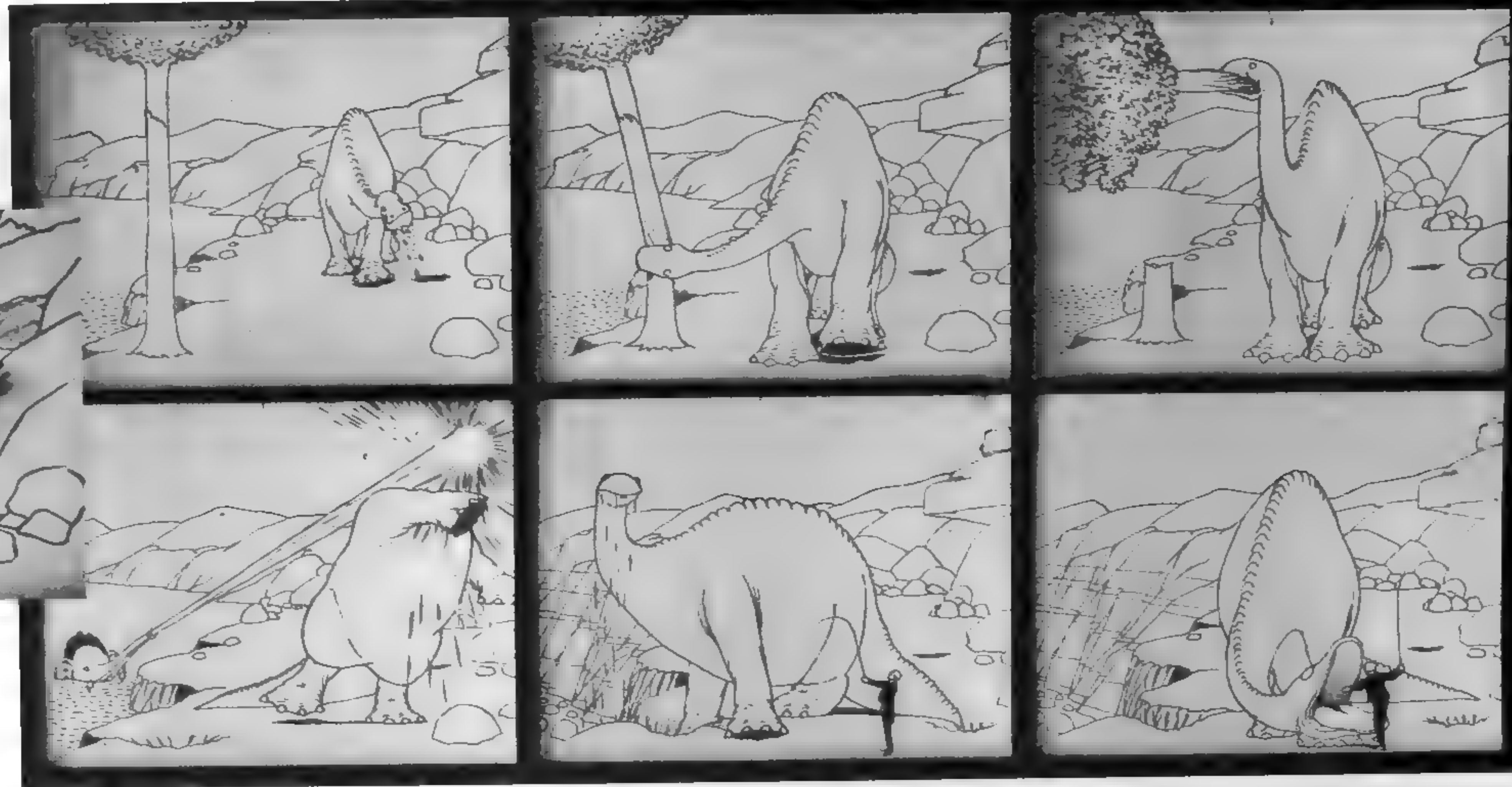
Gertie the Dinosaur (1914)

Animated and directed by Winsor McCay

BOTTOM, RIGHT: By tracing the ever-changing animated character drawings onto transparent cels and rendering them in opaque paint, McCay was free to render the static scenic elements, both foreground and background, with a painterly level of detail. At the time few others followed his example, preferring the economies of a simpler outline style for both characters and environments.

Centaurs (1921)

Animated and directed by Winsor McCay



TOP In this 1921 notebook page, we can see how Winsor McCay's methodical approach to the creation and photography of individual drawings paved the way for both the design and function of later animation exposure sheets.

LEFT Notes for *Flip's Circus* (1921)

Animated and Directed by Winsor McCay

CENTER Handwritten X-sheet from *The Thief and the Cobbler* (1993)

Directed by Richard Williams

another, snapping a tree in two, swallowing both halves of it (including the roots), surviving a high-pressure jet of water sprayed toward the audience in clear depth perspective by a passing mastodon, and then thirstily draining a lake of water from under her attacker. McCay and his assistant even animated realistic contact shadows beneath Gertie's enormous feet, the better to "plant" her on the invented ground plane of the hand-rendered lakeside.

The ravaged landscape she leaves behind her when she finally clears the screen is so radically different from the peaceful idyll into which she was first tempted that the audience's applause must, in part, have been for the chance the routine afforded them of entering into such a believable, not to say interactive, imaginary realm.

As Canemaker so rightly points out, even if they could have matched McCay's astonishing patience and drive, most of his contemporaries could never have hoped to match the quality of his draftsmanship:

It's beyond *Felix the Cat*, which came later, but which was very simple. McCay's animation gifts were effectively "Disney" twenty years before Disney himself hit his stride.

All the key components of contemporary layout design and practice are to be found, in some form or another, in McCay's work. At the time, however, few of his techniques were either equaled or implemented in any meaningful way by his competitors because the labor and cost required would have been enough to bankrupt any studio with even semi-serious commercial ambitions. McCay certainly demonstrated what was possible, but it took another two decades for Disney and his team to render the same kind of effort genuinely practicable.

RIGHT Digital X-sheet in which the user interface presents the information regarding artwork elements and frame counts on a computer screen.

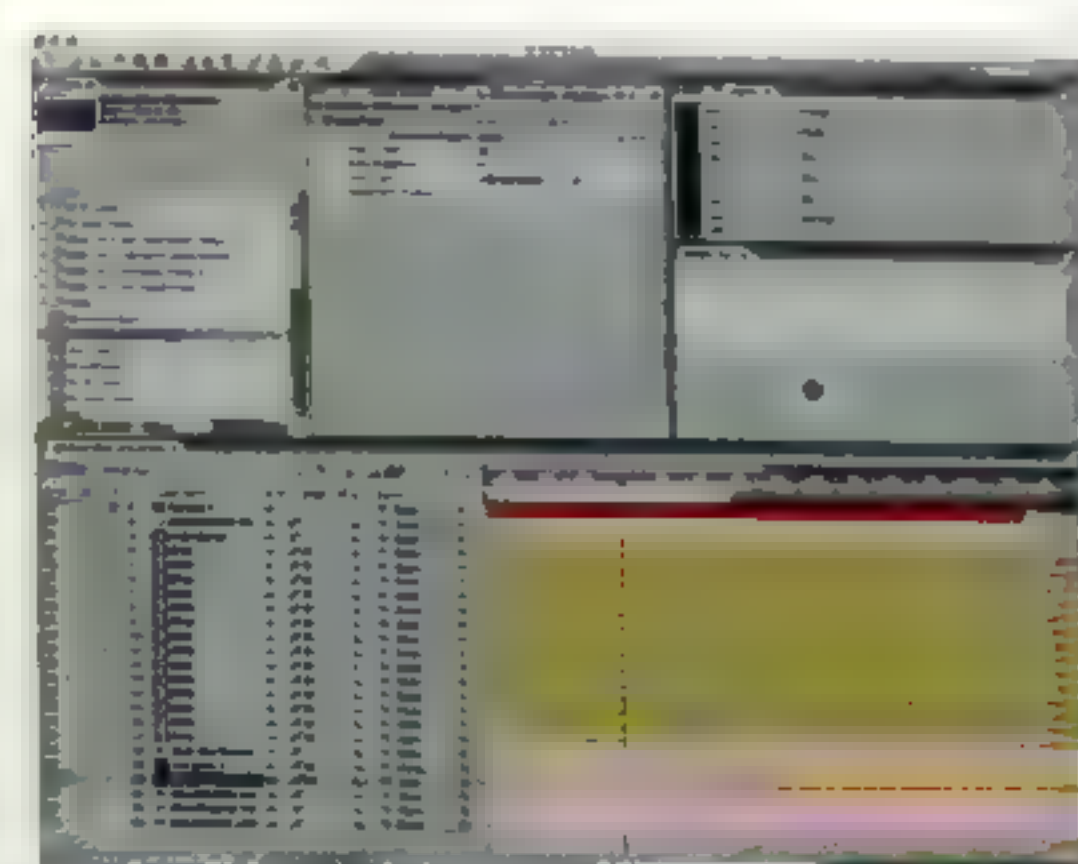
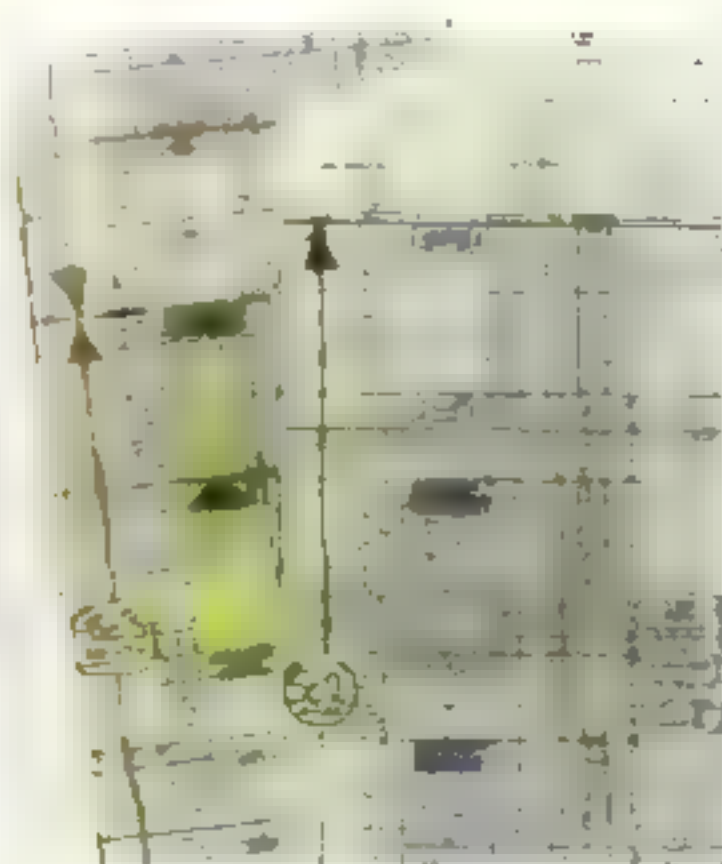
The Princess and the Frog (2009)

Directed by Ron Clements & John Musker

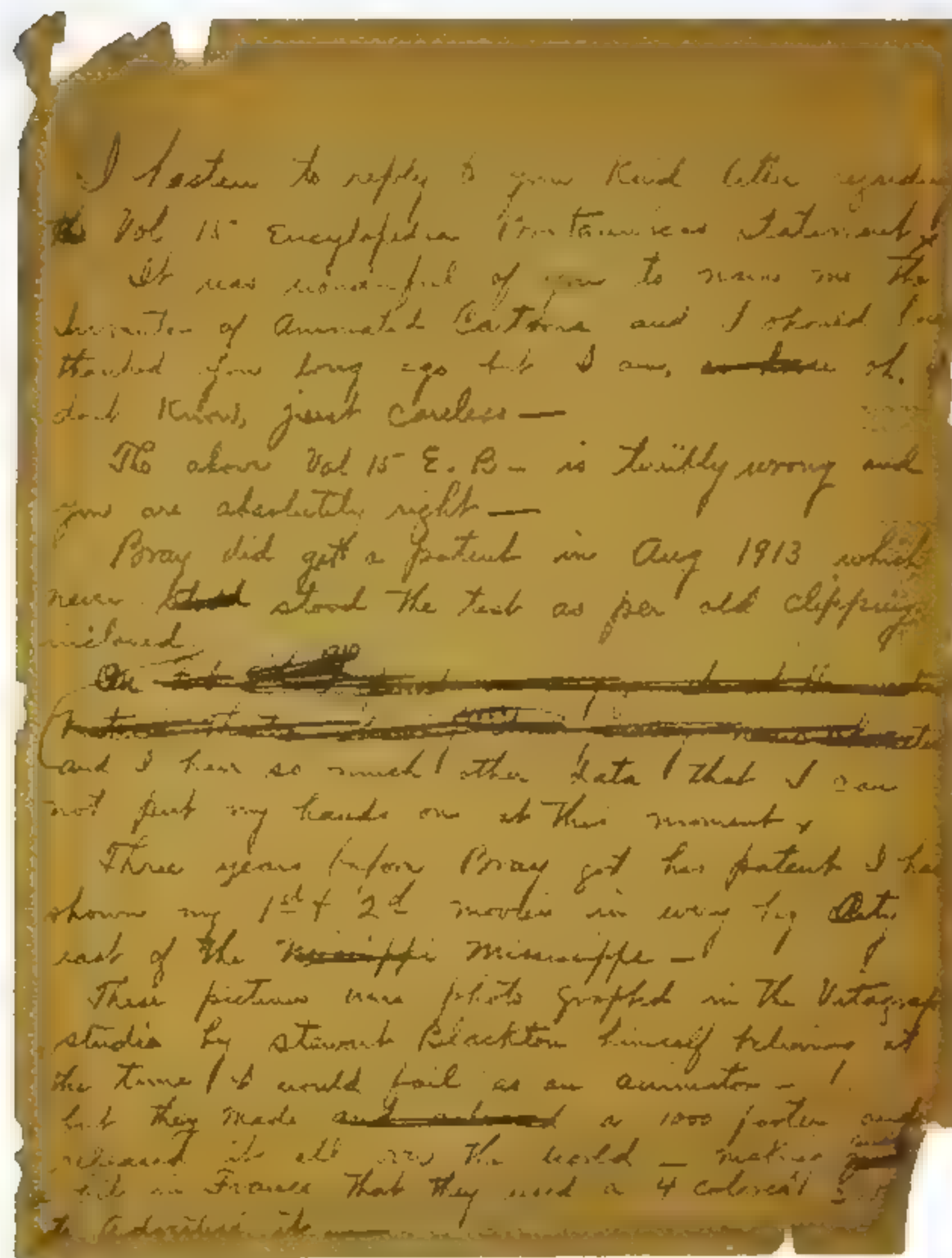
BOTTOM Two pages of staging sketches which prefigure the later development of character layout as a distinct production step and show how carefully McCay planned the interaction of his central characters with the environments they inhabited.

Notebook pages for *Gertie on Tour* (1921)

Animated and directed by Winsor McCay



LEFT: In this reply to a letter from a well-wisher, Winsor McCay writes, "It was wonderful of you to name me the Inventor of Animated Cartoons," then goes on to argue wearily against both the Bray/Hurd cel patent and what he considers to be a misleading entry in volume 15 of the *Encyclopedia Britannica*.



I hasten to reply to your kind letter regarding the Vol. 15 Encyclopedia Britannica statement. It was wonderful of you to name me the Inventor of Animated Cartoons and I should have thanked you long ago but I am, ~~because of~~ ~~dark~~ ~~knows~~, just careless —

The above Vol. 15 E. B. — is terribly wrong and you are absolutely right —

Bray did get a patent in Aug 1913 which never stood the test as per old clippings enclosed.

~~On the 1st of Dec 1913 I was notified that the patent was granted to me and I have so much other data that I can not put my hands on at this moment.~~

Three years before Bray got his patent I had shown my 1st & 2^d movies in way by ~~the~~ east of the Mississippi Mississippi —

These pictures were photo graphed in the Vitagraph studio by Stewart Blackton himself believing at the time I would fail as an animator — but they made and showed a 1000 footer and released it all over the world — making good in France that they used a 4 colored 5 ft. to advertise it —

images that stay still, and second, how to maintain the alignment necessary between successive, sometimes minutely different, levels of artwork.

Early on when he was still drawing his figures on translucent sheets of rice paper, McCay employed a system of hand-drawn crosshairs that had long been in use among commercial artists and printmakers as a means of aligning separately rendered elements that had to match accurately when combined. Positioned at the four corners of each sheet, these simple registration crosses allowed an animator to achieve the same vital continuity when creating each drawing. To maintain this continuity when the successive drawings were then photographed, McCay mounted each one onto

RIGHT: To maintain registration between subsequent drawings, Winsor McCay drew matching crosshairs at each corner of the thin rice paper before mounting every sheet on an identical rectangular card; the cards would then be slid, one at a time, into a shallow groove cut into a vertical wooden frame that held them in alignment in front of the camera lens.

Little Nemo (1911)

Animated and directed by Winsor McCay



a separate rectangle of identically trimmed card which, in turn, fitted into narrow grooves cut into a simple three-sided wooden frame. The frame itself was then fixed firmly in place in front of the camera.

Increasing industrialization of the animation process meant that by the 1930s, many methods and toolkits had become standardized. Because it was difficult to draw directly onto cel and impossible to make clean corrections to lines rendered in ink, it remained common practice for animators to draw in pencil on paper with the final, clean drawings then being traced, in ink, onto the cels.

Registration proved simpler and quicker to achieve when each artist in every department was

In the meantime, since it was difficult and expensive enough to create a complex sequence of subtly different character drawings, how on earth were even the most committed cartoonists ever going to be able to avoid (or afford) the daunting labor of re-creating every last feature of any non-moving background that might appear behind the animated figures?

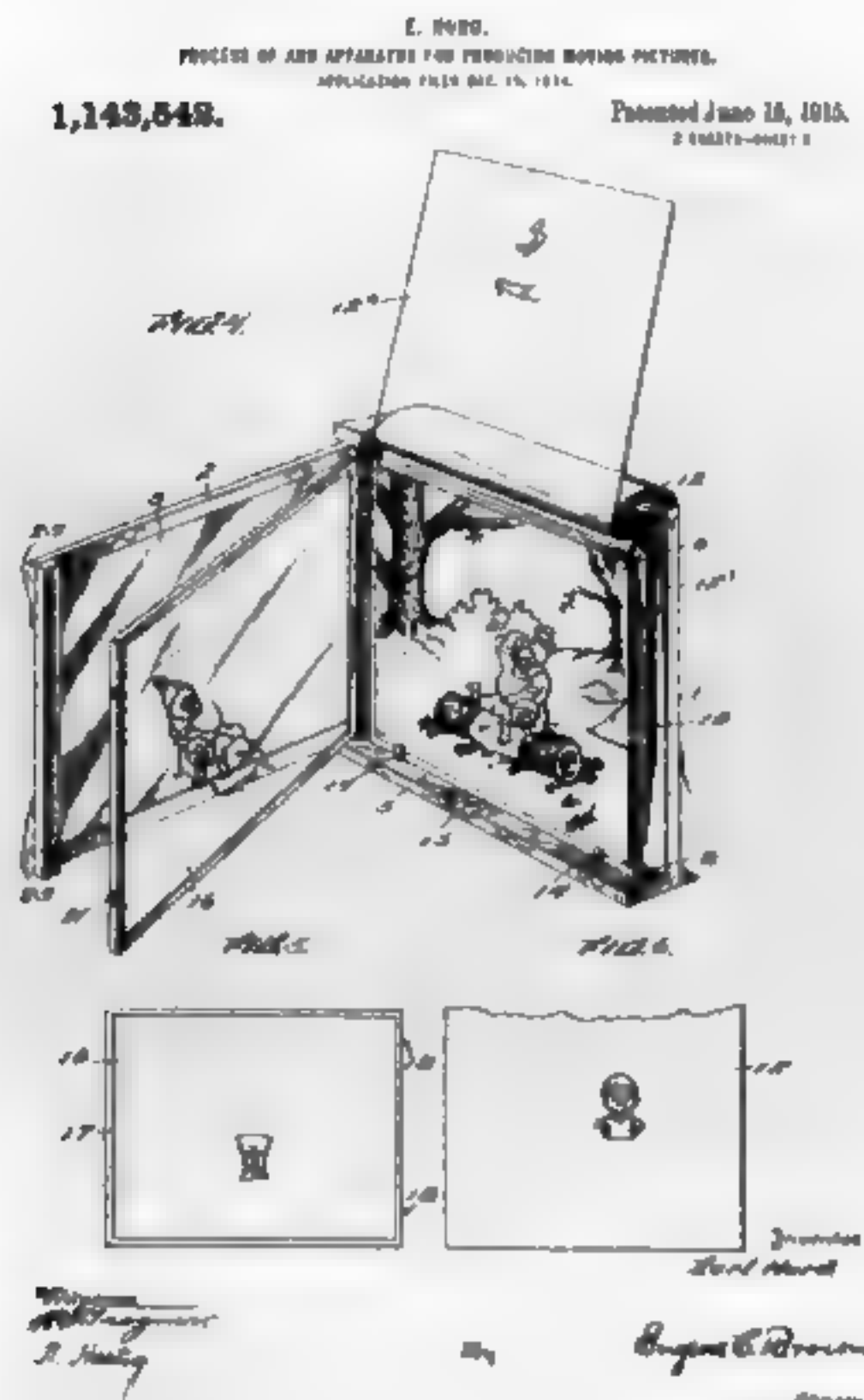
CEL DIVISION: AN IMPORTANT PART OF THE PROCESS BECOMES CLEAR

Filed by cartoonist Earl Hurd on December 14, 1914, U.S. Patent 1,143,542 provided a clever solution to a rudimentary practical problem that was meanwhile frustrating so many of McCay's competitors. By drawing character outlines one by one onto sheets of transparent celluloid, the moving parts of a film cartoon image could be separated from those elements that remained stationary.

John Randolph Bray, another inventor experimenting in the field of animation technique and apparatus, eventually entered into a business partnership with Hurd in 1917 that combined the two men's respective patents and inspired them to demand that all animators working on celluloid rather than paper pay them a license fee. As can be seen from his correspondence and notebooks, McCay fought successfully in court to assert his own right to use a comparable labor-saving approach free of charge, having arrived at much the same method through independent experimentation with similar techniques and materials.

What matters most about Hurd's original design, however, is not that it helped spark a legal and territorial row between rival animators, but that it represents an important (if primitive) attempt to address two important practical problems in the creation and photography of animation artwork: first, how to isolate the simpler drawn elements that move from the more laboriously rendered scenic

Though they offer practical and ingenious solutions to a number of problems, these original diagrams from Earl Hurd's 1914 patent application show clearly how cumbersome early procedures for photographing animation artwork could be in the years before the earliest commercial rostrum cameras were developed and refined.



issued an identical strip of metal, fitted with two or more pegs that corresponded to holes punched in the edge of every sheet of paper and every sheet of cel. A peg bar would also be fitted in front of (or below) the lens of the camera so that the person photographing the cels could fix each drawing in place quickly without having to accomplish registration by hand or check it by eye for every exposure.

Though some studios continued to photograph artwork that was held upright, gravity helped keep hand-rumpled drawings and heat-curved cels flat, and it was found that a hinged sheet of glass positioned over the artwork to hold it flat added to the clarity and quality of the final image.

Hurd's 1914 design is for a freestanding wood and glass cabinet not unlike a large, heavy book in which the pages (in this case the "very transparent sheets") are bound along the top edge, at right angles to the spine. At first glance, the illustration for the patent seems to offer the comfort of peg registration along the lower edge of these sheets, but on closer examination of the text, what appear to be registration pegs in the diagram are in fact merely clips designed to hold the lower edge of the tightly bound "flip book" pages steady once they've been lowered into place in front of the separate layer of background artwork.

The patent describes at length how lines can be drawn directly onto cels that are already fastened into the cabinet, and it includes clear descriptions of familiar techniques such as opaqueing the cels (the process whereby a final layer of paint is added to the back of the cel before photography to ensure the total opacity of the painted figures). It even includes a step-by-step guide to performing trace-back animation, implying that Hurd intended the device to act as a kind of combination artist's desk and camera rostrum table.

It would be difficult, however, for anybody in a modern animation studio, familiar with the convenience of securing individual hole-punched cels and background levels on free-floating peg bars, to warm to the cumbersome procedures Hurd goes on to describe as being essential to the efficient operation of the device. Interestingly, he turns at one point to the question of cel buildup:

I have used, in practice, sheets of such transparency that a plurality may be superposed in succession over the background without materially dimming the clearness thereof, so that the picture or scene which is photographed may be made up of the background and one transparent sheet, or a plurality of transparent sheets superposed thereon,

each having thereon a part or element of the picture. I believe I am the first to employ a transparent sheet or plurality of transparent sheets in conjunction with a background which is photographed therethrough upon the negative film.

If a sequence is short enough, the person photographing it could, Hurd implies, simply allow one "very transparent sheet" after another to build up at the front of the cabinet in the hope that any cumulative dimming of the background artwork would be imperceptible to the audience. But if you have to keep your scenes short and use only the finest, most translucent plastic, and if only so many cels can fit into the binding at the top of the device anyway, just how viable a process was this going to be?

In effect Hurd is allowing for the fact that once a sufficient number of transparent sheets have accumulated at the front of the cabinet, the visibility of the background artwork is bound to become impaired. The solution he offers to the problem is not pretty: the camera operator has to open up the cabinet, lift the accumulated top-bound cels out of the way, swing the background artwork forward on its left-mounted hinge, then place the superfluous sheets of celluloid where they can be clamped neatly out of sight *behind* the background artwork which the operator must then fasten tightly over them.

This is all before repositioning the entire cabinet and continuing to photograph the remaining cel setups, of course.

In a rather unlikely get-out clause, he even suggests that instead of using individual sheets of celluloid bound along one edge, the artists might prefer to use the kind of continuous roll of celluloid still to be found today in florists' shops, although there's no clear indication of how this might work. Some tasks are described as being easier to perform with the cabinet in a vertical position.

Out of the Inkwell



One of the Fleischer Studios' camera operators pictured in a 1920s *Film Fun* article; although this particular rig does include a hinged glass platen, peg registration at the top of the page and diagonal lighting, the fixed camera housing offers no means of approaching (or "trucking in" to) the artwork.

Other parts of the process may, Hurd explains, be more readily accomplished with the device lying flat, so it's perhaps surprising that he includes no clear suggestions about how the camera operator might maintain any kind of fixed relationship between the artwork trapped tightly inside the cabinet and the camera pointed at it.

While it's heavy on the kind of labor-saving detail that might gladden a cartoonist's heart, the original Hurd patent document, from which the words "animation" and "animator" are entirely absent, is worryingly vague about how the resulting material is to be photographed. His claim that "much labor is saved, and the process of preparing the cartoons for the photographer is greatly facilitated" can't have been much easier to swallow in 1915 than it is now.

The system did allow for additional scenic elements to be pressed on top of the cels, giving the appearance in the final projected film of characters passing between objects in space, just as actors would pass between flat pieces of painted scenery in the more familiar make-believe landscape of the theater stage, although in practice it must have been tempting to keep all nonessential elements to a minimum.

Prior to Hurd's invention, less determined artists than Winsor McCay had opted for something known alarmingly as the "slash and tear" system, which involved ripping the paper around your hand-drawn characters and then repositioning each ragged, uneven shape precariously over a single, untorn piece of background artwork, so the appeal of any functional, more streamlined system is easy to see. To some extent, the appeal of the Hurd system was offset by the cost, to anybody other than Bray and Hurd themselves, of utilizing any of the eight separately listed component parts of the claimed technique, the patents for which were not to run out until 1932.

In practical terms, for all the labor the artists were spared in not having to redraw all the noncharacter elements in a scene, the 1914 Hurd cel method both increased and complicated the effort involved in creating and photographing the artwork. Light passes through celluloid, yes, but it also bounces off it, so reflections were more of a problem than they were with artwork created on paper. Bright lights were required for a clear exposure, and keeping one level of paper artwork flat in the resulting heat had caused problems enough, but faced with a thick club sandwich of cel, card, and paper trapped in a heavy box, who'd want to be an animation camera operator?

LATHE BEDS AND FIXED FIELDS

With the profusion of image manipulation software available now, it's difficult to believe that less than a decade separates us from a world in which, as a matter of routine, individual elements of a scene in any animated or special-effects movie had to be manually created, manually photographed, and then chemically processed.

In the earliest years of the American animation industry, as animator and historian Ray Pointer makes clear, it was largely up to the practitioners themselves to develop the appropriate techniques and apparatus:

The majority of the early animation camera setups were pretty much invented by the companies themselves. Most were adapted by the use of a lathe bed, and they engineered a camera cradle that would work on that lathe bed with increments. It was sort of an outgrowth of a photostat camera. In the early years you only had two mechanical processes in shooting animation: the camera was at a fixed field and it did not move forward or back relative to the art, so the only mechanical movements that you had in the

...the voiceover to this 1938 documentary explains that “the characters must be provided with a fitting environment,” prompting a visit to the department where “settings are designed and decorated by artists whose work is just as important—and perhaps more complicated than figure animation.”



...While most commercial rostrum camera work for animation was (and still is) conducted using an overhead camera, pointing down at layers of flat artwork fixed on a horizontal “compound” table. In the late 1930s the camera operators at the Fleischer Studios used a technique that involved clamping peg-registered artwork into a hinged metal frame, which was then raised to a fixed, vertical position in front of the camera lens.



...earliest cartoons would be horizontal or vertical pans. The vertical pan was made possible simply by turning the camera 90 degrees, but other than that the camera never approached or receded from the art.

Though most of these early camera rigs have long since been abandoned or dismantled, some remained in use for many years. As Ray went on to explain:

I have the Fleischer Studios production manual, which is very revealing. They had no real ability to shoot in as universal a situation as you could on an animation stand, with the choice between shooting at a 12 field¹ and trucking in as close as you wanted to. They had basically three types of cameras and the one approach camera they had was fixed at a certain field, so if they had a scene

that required a certain kind of a movement, it had to be assigned to a certain kind of a camera and the layouts had to be specifically tailored to that camera.

Gradually, as the industry became more established, camera manufacturers began to take notice, offering design solutions of their own, many of which provided greater mechanical control over both photography and handling of animation artwork:

By the 1930s, the majority of the studios had cameras and animation stands such as the Aeme/Bowlds², which introduced more mechanized photographic processes. The compound³ was engineered with calibrated tracks assigned to the peg bars and to the camera column, allowing measured lateral movement of the art as well as camera

approaches or “truck ins.” This meant that you could do the various effects that were necessary and at the same time control the exposures of the film mechanically so that you could go backward and forward which, especially when we get into Technicolor, made the control of multiple exposures much more possible. You had to have precise mechanical control and registration of the film in order to make the progressive exposures⁴ that were necessary for the three-color process.

From the 1930s up until the mid-1980s, every on-screen movement in a traditionally animated movie had to be manufactured either manually or mechanically, and often the results could only be viewed once the final photography had been completed and the resulting film print had been sent back from the lab for projection in the studio viewing theater.

LEFT Brochure image for Fax animation camera stand (1980s).

RIGHT Brochure image for Bowlds animation camera stand (circa 1950).



During his time doing contract rostrum work in Nick Vasu's Hollywood camera house for various studios and productions all over town, this meant that, as a matter of routine, Tom Baker, a former animation camera operator and now a digital layout artist at Walt Disney Animation Studios, would be required to set up and photograph thousands of character cels in any given day, then restack them, change the lighting setup, and photograph them all over again. Factor in the constant opening, closing, and cleaning of the platen glass that held the artwork flat against the rostrum tabletop and, even with the simplest of scenes to photograph, you had a demanding, repetitive, and nerve-racking day, far removed from the comparative luxury of peering through a camera viewfinder at a bunch of actors on a set:

I worked on two different Acme Cameras, both manufactured in Hollywood for very specific purposes. Acme, Mole-Richardson, and Oxberry were the big players at the time. Most of them used Mitchell camera components for the film box, film gate, sprockets, and camera drives. Acmes were great because they were built to specs. They were great cel-flopping cameras for animation, especially TV work. Very functional and very comfortable. Some of the other cameras I worked on were functional but not so comfortable and noticeably slower to operate.

Turning a gear wheel on the vertical tower of the stand would cause the body of the camera to approach or retreat from the artwork on the table (a movement referred to as *trucking*). Most camera moves in traditional animation, however, are not camera moves at all, they're *artwork* moves, performed a frame at a time on the rostrum (or *compound*) table beneath the locked-off camera, so smaller, precision-engineered gear wheels

ANIMATION STAND of new design

REFERENCE

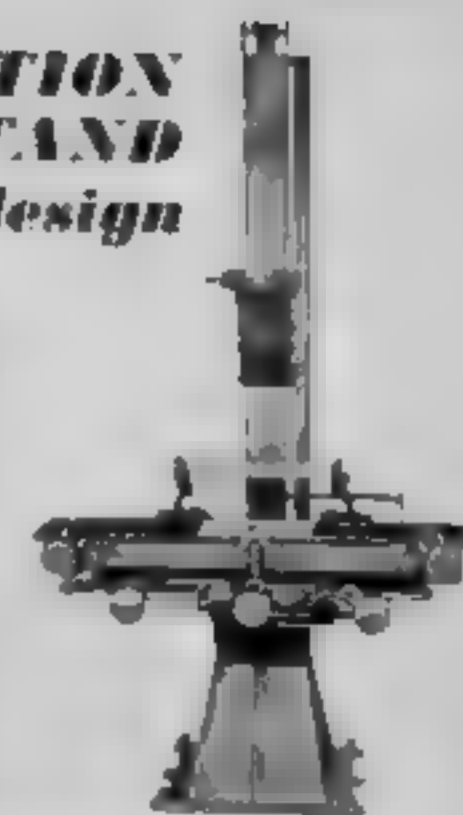
The Bowlds Animation Stand is a new design in the animation industry. It is designed for the most efficient and accurate operation of the camera and is the most complete and reliable camera stand ever designed.

FEATURES

- The camera is mounted on a vertical tower which can be moved in any direction.
- The camera is mounted on a vertical tower which can be moved in any direction.
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SPRINGS: The Bowlds Animation Stand is a new design in the animation industry. It is designed for the most efficient and accurate operation of the camera and is the most complete and reliable camera stand ever designed.

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positioned at the edge of the rostrum bed could be turned by the operator, an increment at a time, in order to move the different top and bottom peg bars that were mounted in long sliding strips on the rostrum tabletop.

Some camera stands were rigged so that the camera itself could rotate about the center of the lens relative to the artwork, but on most commercial rostrum beds, any required rotation was created by moving the entire package of platen, cel, and background artwork on a geared glass and metal disc mounted in the tabletop. For rostrum companies working in the open market, it was essential to have a choice of different camera rigs available, not only because of the volume of work that might be going through at any one time but also, as Tom makes clear, because each setup had its own particular strengths:

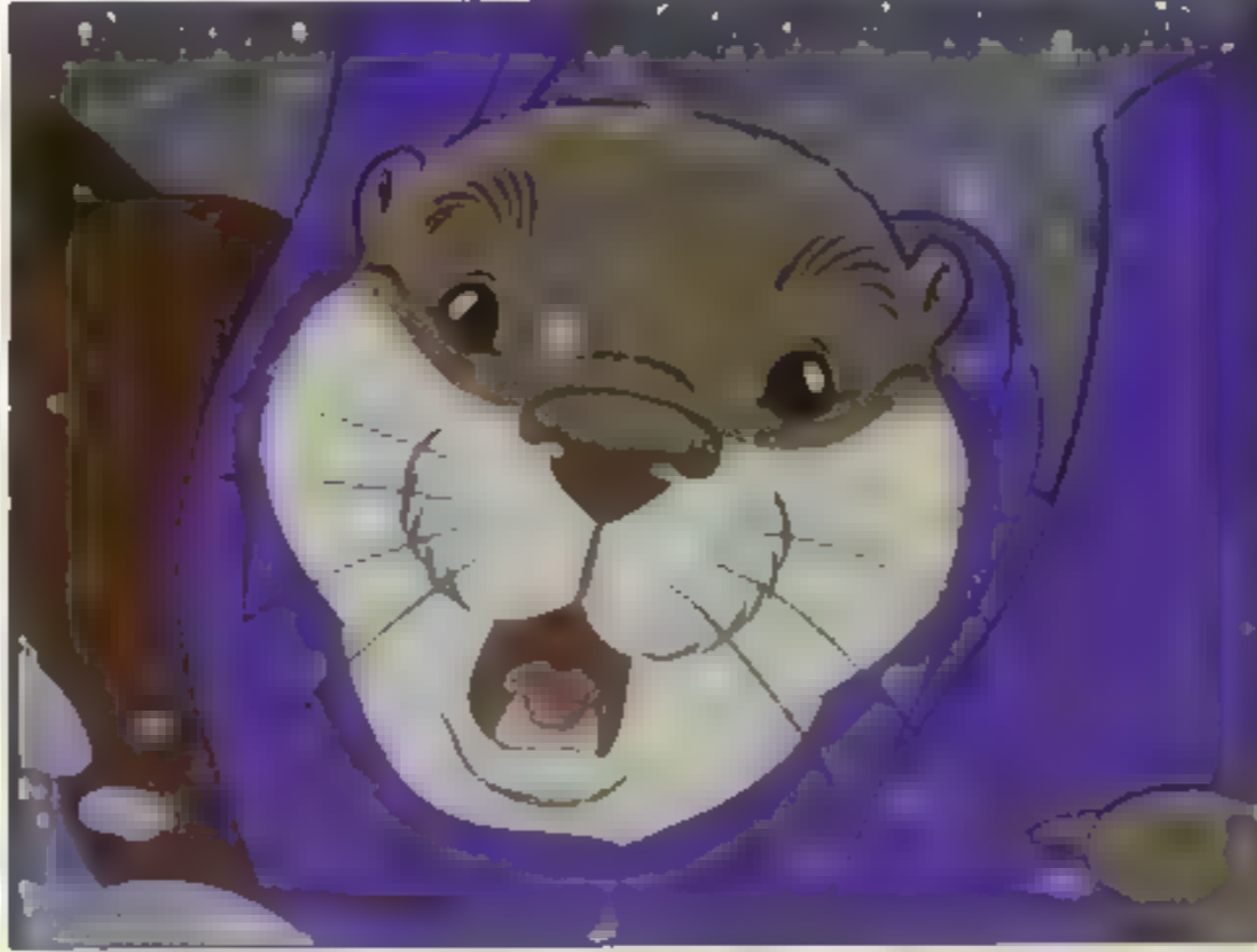
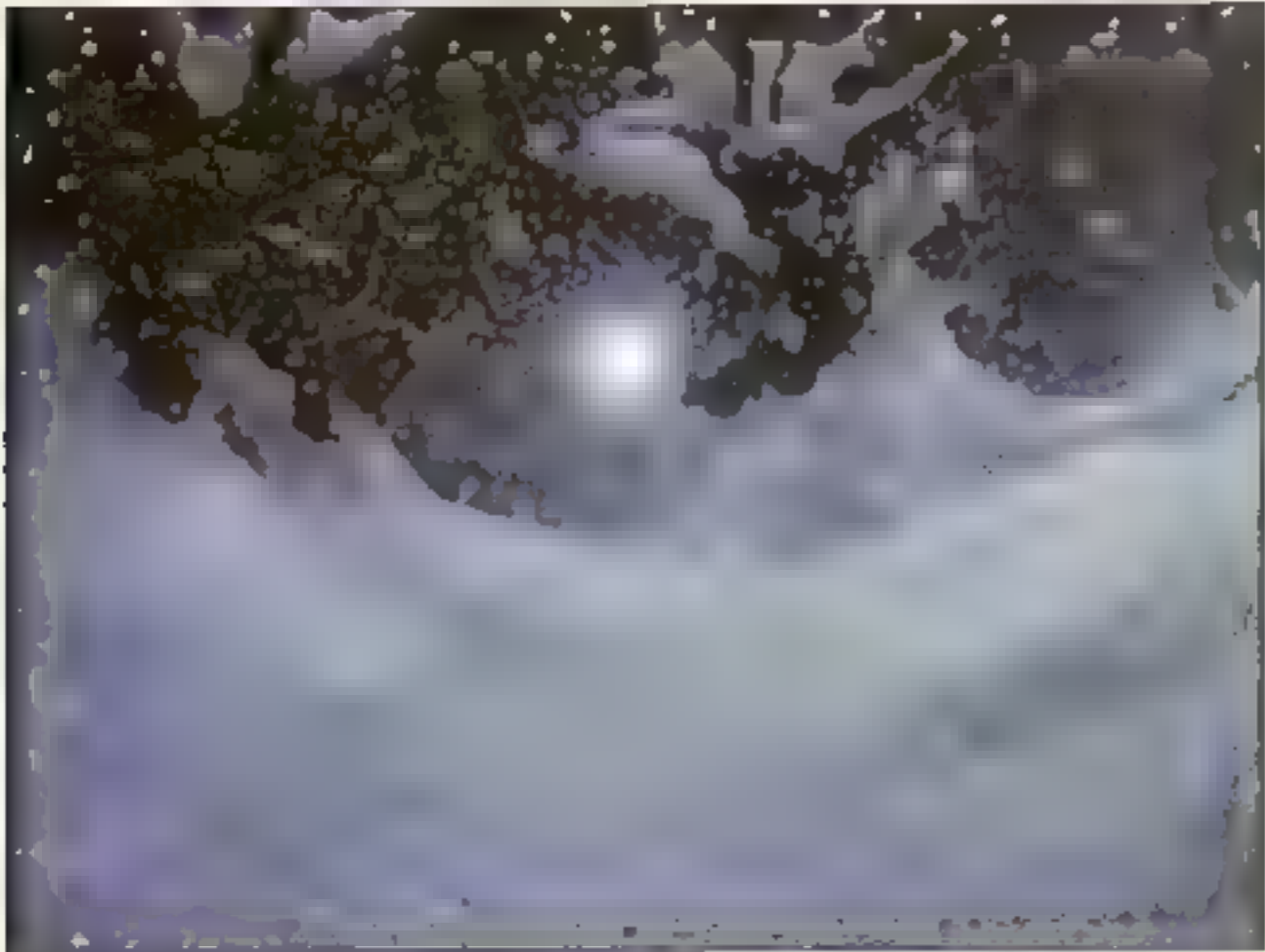
On the Acme cameras, the head moved, not the table, so it was inconvenient to do any trucks longer than a 24x. The Richardson was always used for the more complex pan shots because it had the four pan bars, but it had to be a 12 field setup for those. If we needed four bars or anything larger than 16 field, then we shot those on the

As Richard Wolff explains, "In *The Willows in Winter*, Toad has an old-fashioned biplane so we had various sequences with him flying over the English countryside in all sorts of different weather conditions. Between the lens and the camera table we fixed a sheet of glass which could be moved around in all sorts of ways over the different background paintings of the countryside. The animation level of Toad piloting the plane was fixed to one peg bar on the glass sheet and then underneath that you had the background artwork mounted on the sliding peg bar of the camera table so it could be

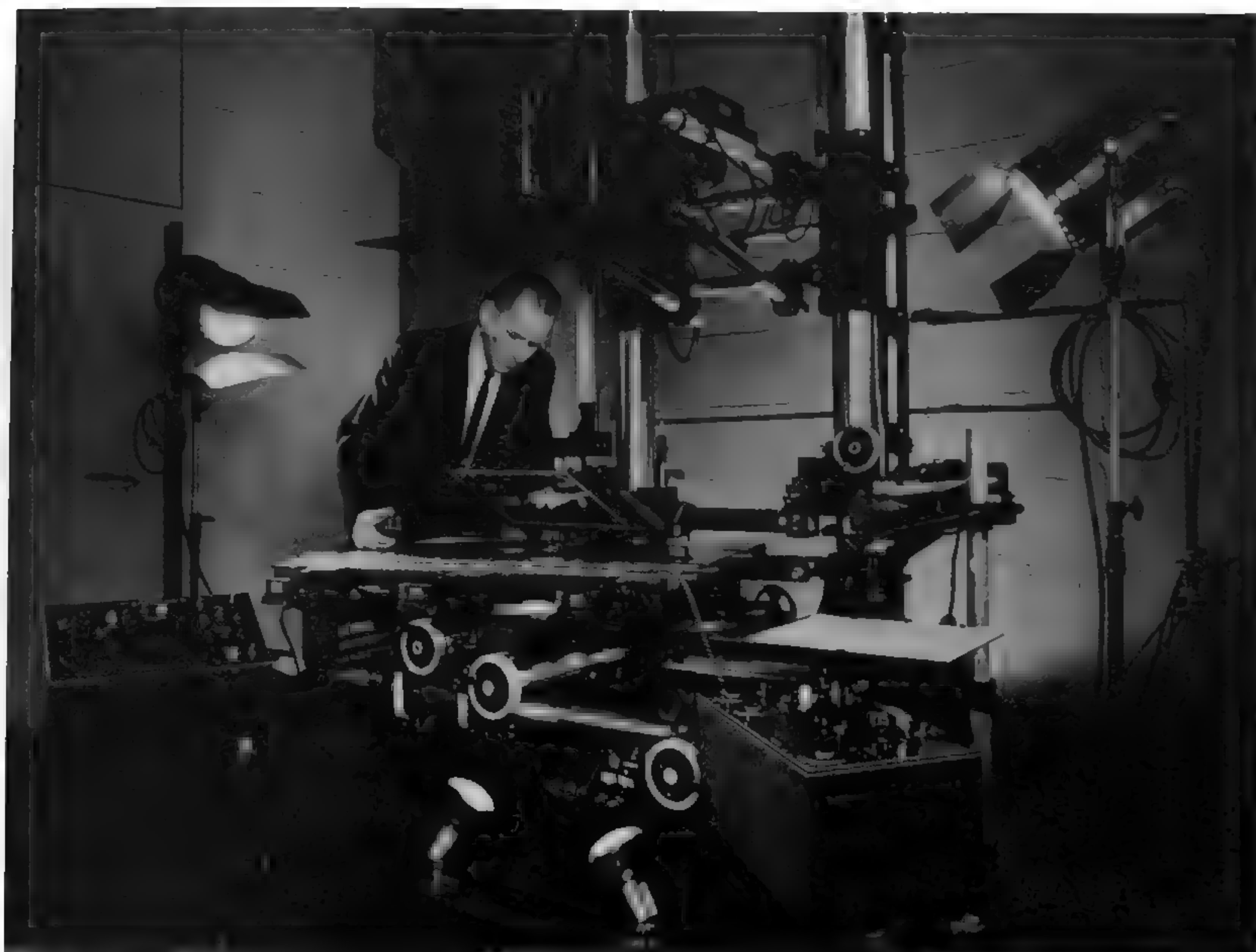
moved in different ways to create the illusion of flying over the countryside. We also had cloud effects which we partly burnt on as a separate run (or exposure) so it created some interesting layout situations for Ray Rankine, the head of layout."



By repositioning and rephotographing one level of hand-drawn effects animation several times over, the camera operator was able to give a greater sense of depth to the falling snow in the completed version of this dark winter scene.



In contrast to the purely repetitive demands of high turnover commercial work, the fastidious nature of rostrum work is clear from this archive photograph of camera operator Andy Chandler operating an Oxberry animation camera at Reid H. Ray Film Industries, St. Paul; though many of the controls were computer-operated by the 1990s, in the '50s each incremental movement had to be executed by hand.



Oxberry cameras. One drawback to shooting with bottom lights was that some cameras had fluorescent bulbs that were not very bright, though they were nice and cool to the touch. So the exposure times on those had to be longer.

Musicians become one with their instruments; the pencil and the brush seem, after a while, to become extensions of the artist's hand; and for the craftsman whose working life was spent operating and caring for something as complex and refined as a modern animation rostrum camera

(like an Oxberry, Acme, or Richardson), the feeling of being at one with your machine was a vitally important one to achieve.

In addition to being at one with the camera rostrum stand and all its controls, the operator had to process a volume of handwritten information. Different instructions came with each scene, some written in verbal form in the camera column of the exposure sheets, others appearing in numerical form alongside or arriving as full-size peg-registered diagrams called camera guides, which the Layout Department would prepare to help the

operator plan and set up the frame-by-frame photography of the scene.

Usually drawn in red pencil with the wording in bold capitals, these camera guides indicated what the required fielding (or aspect ratio) of the scene was, where the N/S, E/W (North/South, East/West), and START and END (first frame and last frame) positions were for any requested moves, and also what the direct or curved path might be between those two points. The line describing the path of camera movement on the diagrams would also be punctuated by tiny perpendicular marks indicating the center point of each successive frame exposure. In the days before computerized motion control, the operator would have to translate all of this information, live, into the incremental, frame-by-frame movement of the gear wheels that controlled the relative positions of each layer of background and cel artwork beneath the lens of the camera.

"NONLAYOUT" LAYOUT

From the advent of television up until the present day, the animation industry in London has continued to be a world center for the production of animated TV commercials. The turnover and production pipeline of this industry are not so far removed from the pattern of work at the early East Coast studios in America, where artists like Otto Messmer and the Fleischer brothers and entrepreneurs like Pat Sullivan were involved in the production of high-turnover, short-format work. In any search for clues about the origin and development of hand-drawn layout techniques, it's important to bear in mind that one side effect of working in small teams with tight deadlines is the need for artists to multitask, as independent camera operator John Leatherbarrow explained when I asked him about his early years of rostrum work in London's West End in the 1970s:

Designed to look as though a series of Victorian-style engravings had come to life, the Ben Truman "Barge" commercial (produced in 1983 for London agency Butler Dennis Garland) featured a slow-moving canal barge traveling through long brick tunnels and sleepy rural locks to arrive alongside a country pub at sunset. Two particular wide-angle shots, one of a large factory built of bricks, the other an overhead view of the barge slowing to a halt, required layout and background artwork so large a hole had to be made in the ceiling above the camera "tower."

Truman's "Barge" commercial (1983)
 Directed by Richard Williams
 Layout by Roy Nisbitt
 Camera operator Richard Wolff



In those days at most animation companies in London there weren't Layout Departments, they didn't exist. That was the responsibility of either the director or the animator themselves.

Recalling his own work in and around Soho during the same period, Richard Wolff, another freelance cameraman with many years of working experience in both the United Kingdom and America, described much the same, nondepartmental approach to the creation of the artwork and the planning of the photography:

It varied a lot because sometimes there wasn't a layout artist as such. Obviously there was, because somebody had to do the work. I suppose the more complex it is, the more you think, "This is layout," but in a way it's all layout, even if it's simple. If you do straight-ahead animation on a 12 field, it's still a layout because a decision has been made to do it in that way.

As a camera person, I suppose the way you think about it is probably starting simple, just holding the frame. And then people would sometimes have a *truck in* and go to a certain field within

that and they might move north/south or east/west, you might pan the background from left to right. Ninety percent of the time it was quite tight and you had to start and finish a track in a certain place. You could move the camera up and down so you could probably go out one frame,⁸ something like that, but you were expected to hit the nail.

Oddly enough, even when it was as tight as that, the one thing that was usually left to the cameraman was the graduation. In most cases if you were doing a *cushion-in* and a *cushion-out*, you were working out those increments yourself.

STARTING OUT

Inspired to pursue a career in photography by Antonioni's *Blow-Up*, in 1969 John Leatherbarrow found himself pointed in the direction of Brian Stevens's Rostrum Camera Company in London's Denmark Street:

I worked down in the basement for a guy called Alan Foster. I learned a lot from Alan, working more or less twelve hours a day, and that's how I started off, getting his tea and buns and operating the camera—and I learned just about everything.

After graduating from film school, Richard Wolff worked briefly as an assistant cameraman in live-action but then heard there was a vacancy for a trainee rostrum cameraman at the Halas & Batchelor studio in Kean Street on the edge of Covent Garden:

There was one older camera guy at the studio who had a bit of history behind him; he'd been in live-action before and apparently had worked on *Blackmail*, Hitchcock's first sound film. There was a guy there doing *aerial image*⁶ work too, but you couldn't say I was specifically apprenticed to any one individual. Basically the people who were more experienced taught the people who were starting out, so when you had been there a while, you'd teach the next people who came in.

Expanding on the contribution, however modest, that was often expected of a camera operator shooting animation for commercials or a TV series, Richard explained how, even working in isolation from the artists in the studio, it was still both possible and necessary to approach the work with a team spirit:

Sometimes you were just "obeying orders" as it were, but other times you got a relationship going with the animation director, and if you'd got enough time you might quickly shoot an alternative take of a scene. They might have given you the instructions on how to field it, but you might try something, put in a table-turn or something. And sometimes they'd pick up on what you'd done.

In *The Willows in Winter*, TVC had this level of snow animation that they'd used in quite a few films, and it was pretty tired-looking. But because snow's white it can burn in on things nicely so I found a way to make it look like a multiplane by photographing it in different sequences and shooting it at different fieldings to give a 3D effect to it like real snow. And since most of it was in winter, it changed the look of those scenes. Just a simple idea like that can affect the whole look of a thing.

It's all about the teamwork, isn't it? I think somebody quoted Oscar Grillo as saying that even though sometimes the individual might not have a big effect, everybody in the team can make it a little bit worse or a little bit better.

MONKEYS AND WORKHORSES

Having progressed to far more ambitious and demanding projects later in his own career, including both *Who Framed Roger Rabbit* and *The Thief and the Cobbler*, John Leatherbarrow was under no illusion about the more workaday approach taken by some of the less ambitious operators:

Let's face it: in the days when animation was shot on film, a lot of it was very boring. It was a case of putting one cel on after another—and a monkey could do it, no disrespect to monkeys. But a lot of it was very simple and some people were just technicians or button-pushers who weren't capable of

taking it any further, so it was rare that anybody had the vision to allow a camera operator free rein. People thought, "You put it in a box, send it off, and when it comes back, you hope for the best." That's why it's not talked about with respect because there are not many people who did it terribly well.

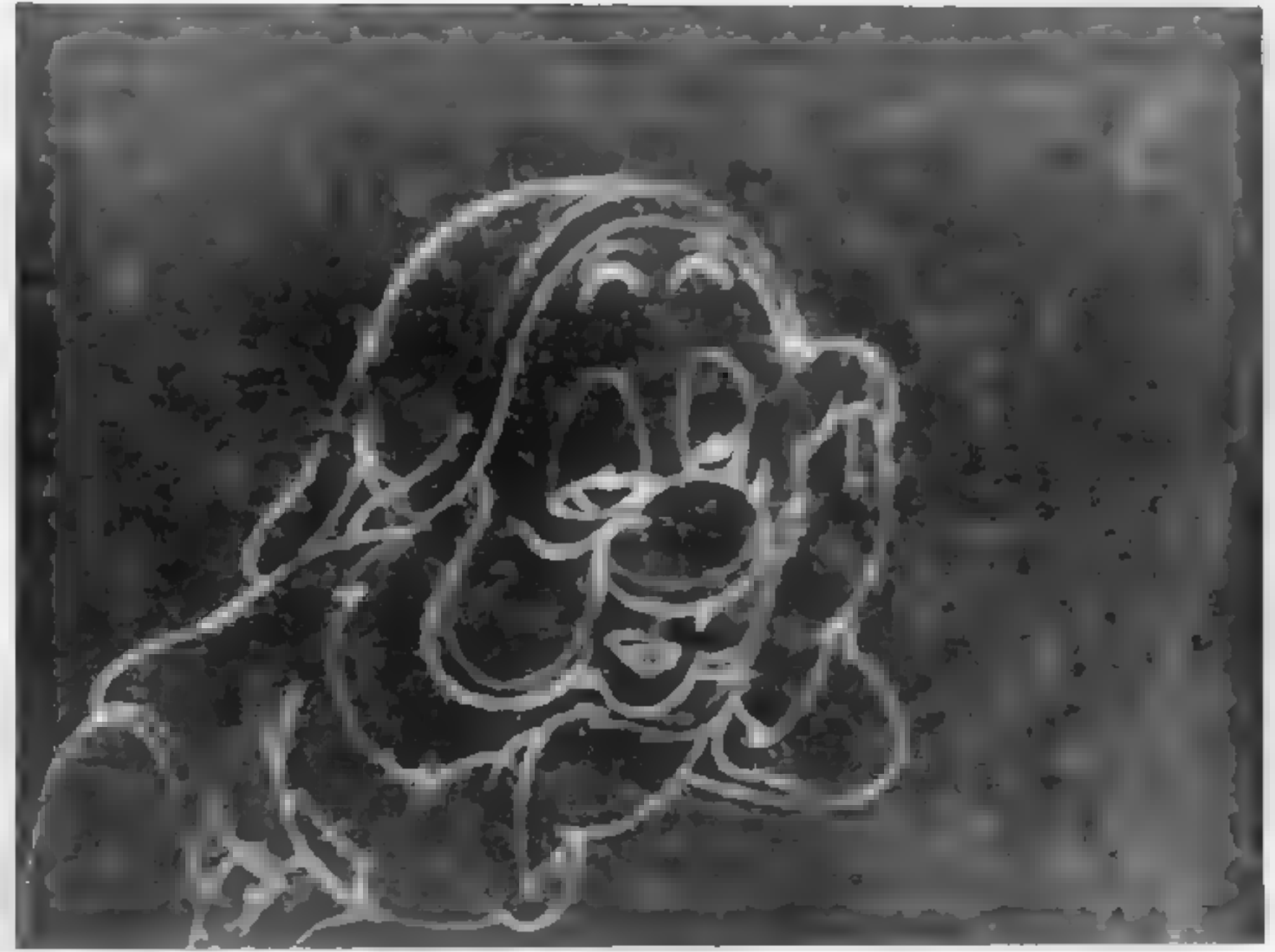
For those who did take the work seriously, however, it was important to invest whatever you could in the best available kit. As Richard Wolff remembers:

When I started out on my own, my first good camera was a Bell & Howell. I had three lenses on it, two of which were really usable. I worked mostly on commercials, but later on I had a partner so I got a 16mm camera for him, and that meant I could work in 35mm on the commercials while he worked on lower-budget medical and information films.

Leatherbarrow likewise recalled the early years of his own working partnership with fellow cameraman Brian Riley, and making the progression from simple photography to the more complex effects work:

One of our first cameras was a 1920s Mitchell and it was so old that it had originally been hand-cranked. But it had been converted and it was the only thing we could afford when we were starting off. In the '80s we actually shot some TV titles on that camera that got mistaken for computer animation!

But Oxberrys tended to be the most reliable. They're all workhorses. Later on, when Brian and I had three floors in Old Compton Street we had three cameras in there, all Oxberrys.



We also used to do aerial image. It was the first way of doing special effects; even ILM [Industrial Light and Magic] used to use them originally. Basically you have a camera and a projector bouncing an image off a mirror. You project films, shoot them up into the camera, and sort of copy them, interfere with the image on the tabletop. You could use mattes and you could add animation. In the very early days of effects that's how you did it.

HOLES IN THE CEILING

Over the years no other London animation studio has nurtured (or hosted) as much talent or generated quite so many stories as Richard Williams's studio in Soho Square. Though he participated in his fair share of more complicated jobs, Greg Duffell, a Canadian animator who served part of his own industry apprenticeship at the Williams

studio in the late 1970s, remembers how mundane much of the regular work could be:

A lot of the time in commercials, because it's short and has to be so direct, there aren't any backgrounds to speak of and there isn't a lot of [camera] mechanics going on. Obviously it varies, but a lot of commercial stuff was *locked down* for the most part.

I worked right beside the camera rooms so I knew what was going through there, but we weren't encouraged to do our own mechanics.⁸ Dick [Richard Williams] had this thing where he didn't want any of us to do those. He would say, "Oh, leave that to the cameraman" and, of course, he had Roy Naisbitt who would work out all this stuff.

Sooner or later when you were working for Williams (or Dick, as everybody came to know him, even if they'd never worked for him), a more challenging job would appear, requiring artwork to be created to a nonindustry size or format, and it was up to you, as cameraman, to find a way of shooting it. As Richard Wolff explained:

There was a famous beer commercial for Richard Williams with layouts by Roy Naisbitt that was quite interesting. The artwork was enormous and physically quite difficult to deal with. That's something you haven't really got to worry about now on computers. I guess Dick must have wanted the background painting to be as large as possible so we could take the lens close up to the artwork, but I had to drill a hole in the ceiling so that part of the camera could actually go up into it. That was the only way I could pull back far enough.

Animator Les Clark marks up the cutting copy of a movie with a Chinagraph pencil, working on a Moviola upright film editing machine; for many years the tiny screens on these machines provided Disney's animation artists with their only means of viewing work in progress outside the projection theater.

The regular platen wasn't big enough either so I had to have a huge sheet of glass cut to lay on the artwork and flatten it. You had to have optical glass, which was relatively pure in color and quality, and a large piece like that had to be handheld too, so I had to get this huge sheet cut with a beveled edge so I could hold it safely. It was a pain in the butt—but an interesting pain!

In the predigital era, the sheer physical awkwardness of much of the work combined with long hours and an almost nonexistent margin for error made the camera operator's life an anxious one. But, as John Leatherbarrow well remembers, the effort itself formed part of a rich education:

Because things were so primitive in the early days, half the time you were shooting, something would go wrong and, at one o'clock in the morning, you had to fix it. You had to learn the process, hands on, by emergency. You had the pressure of working till two in the morning, and then you'd have the anxiety of waiting till the next day and hoping that it worked.

But when you were actually on the camera, the one interesting thing was that as you were shooting it, changing the cels or the drawings or whatever, you were seeing what the animators and the other artists did, you were holding it, and looking at it, and you saw the best. You began to understand about camera moves and layout because you had to. Except for the laboratories and the editor, you were the one at the end of the line.

Of course there weren't computers, everything was very manual. If you had to zoom the camera in, you had to draw the *notches*⁹ and all that. In the early '70s I actually went to see the first computer:



it was run by paper tape with holes in it like an old Telex machine, and it was about the size of two wardrobes!

Image components can easily be created and edited now with a keyboard and a mouse, or with a pen and tablet, but as John and Richard's experiences make clear, much of what we see happening in real time before us on a flat-screen monitor previously took days to accomplish, one slow step at a time, in the separate and sometimes volatile worlds of the camera department (or rostrum house) and the

film processing laboratory. Where it's still used at all, unexposed negative film stock only makes an appearance at the very end of the moviemaking process today, at the point when the final rendered frames are ready to be output to film.

Though he doesn't draw or animate, I've rarely seen Tom Baker without a pencil behind his ear or poised and ready in his hand. A veteran rostrum camera operator and former head of Scene Planning at the Walt Disney Studios in Burbank, he was standing at his desk in the Digital Layout Department when I arrived to meet with him in



November of 2008. Surrounded by monitors, keyboards, and tablets, he still had to put the pencil back behind his ear in order to shake my hand. I was curious to know what his own first impressions had been as an apprentice in the early '80s:

I'll never forget the first time I saw a *down-shooter* camera.¹⁰ I don't know what I was expecting but certainly not what I saw. It was an amazing piece of equipment for a very specific purpose, which was then reappropriated to accomplish all kinds of tasks. The cameras I worked on were utilized for various projects besides animation for TV and theatrical release.

The rostrum cameras were utilized in getting prints, transparencies, and slides onto film stock for things such as the Academy Awards, documentaries, and a lot of Public Broadcasting stuff, not to mention the transparencies of each month's Playmate of the Month for *Playboy*! In fact Disney's cameras were the only cameras I'm aware of that were used exclusively for their own features and nothing else. All their title work was sent out, or at least it was by the time my career started because I shot quite a bit of their title work in the 1980s.

More than ten years into the digital phase of his own working life in animation, Tom still appreciates the wealth of possibilities the earlier, tangible camera rigs offered:

I was extremely lucky. I had two Acmes, two Oxberrys, and one Richardson at my disposal. After 1981 they all had computers that could figure out camera moves. My boss, Nick Vasu, was one of the first to add computer motion control to an Oxberry stand. Before that we did it with an old-school gear-driven calculator since we couldn't round off decimal points when we were turning the dials anyway. The Oxberrys had different motion control software for different purposes and speeds. I would look at each task and choose my camera based on the specifics of the requested shot. It was heaven to have those choices. I used to say several of these cameras were extensions of my body. I knew them so well and they were so loyal and durable that I couldn't imagine trying to do my tasks without them.

Back in 1997, when I first arrived at Disney in L.A., the Scene Planning Department sat at the hub of the studio's CAPS-based "back end," and whatever grasp I had of the production pipeline in those early days I owed to Tom and his crew. Because I had started my own working life as a film editor, it was easy to feel at home among animation scene planners because in the traditional pipeline they too had to juggle the image on the screen with the paperwork that explained not only how it got there but also what needed to happen to it. Like film editors, scene planners also had to make sure there was visual flow and clear pictorial continuity from one screen image to the next.

It was quite possible to work for years as an inbetweener, or as an assistant in traditional special effects for TV commercials, without ever needing to pay much attention to anything other than the framing of the particular shot you were working on. Only those in the key or lead positions needed to be party to what was required at the camera stage. On feature animation crews,

however, much the same could be true for juniors in the character and clean-up departments. By contrast, even the most junior member of any animation layout crew needed, sooner or later, to get a good clear picture of the process involved in actually photographing the artwork.

Many TV animation studios continued to use traditional cel painting techniques and to shoot all of their series work on film well into the late 1990s. Charlie Grosvenor, former head of layout at Hanna-Barbera, recalls being taken on a studio tour in 1978 designed by the outgoing department supervisor, John Ahern, to ensure that the younger artists were up to speed with every part of the production process. Not surprisingly the first stop on their tour was the camera department. As Charlie recalls:

Our department was something like sixty people, so they decided to take all the crew heads and about a half dozen of the younger people from the department that they wanted to build the future on. Fortunately, I was included in that group, and they really gave us an in-depth look at everything: "OK, tonight we're going to show you how the camera works; we're going to show you film sprockets and all this stuff." They were using regular down-shooters, 35mm. And I had never seen a camera before! But the camera guy showed us how everything worked and so after that the six of us had a pretty good idea of what was going on.

The more accustomed we've all become to working with computers the easier it has been for us, quite literally, to "lose touch." We even refer to having information "at our fingertips" in the digital age when the physical material to which we refer is hundreds of miles away and the only tangible object our fingertips can make contact with is the plastic of the mouse and keyboard (or graphics tablet and pen) sitting beneath the monitor.

Operators like Tom knew, by touch, where every physical component and control of their camera rostrum stands could be found, and they understood the role each one could play in the smooth execution of a stunning piece of animation cinematography. Once the film had been successfully exposed they also knew what the technicians at every stage of film processing and grading could further accomplish. With such a wealth of knowledge available to them in the camera department, the more sensible directors and animators knew always to consult the operators ahead of time about any possible shortcuts and economies. Their expertise allowed money to be saved for the more complicated matte or effects passes that some *hero shots*¹³ might require, but which only an optical printer could provide.

Not surprisingly, apprentice camera operators in the larger traditional animation studios were often given the responsibility of photographing what were known as *pencil tests* of the animators' work-in-progress. This gave the department juniors a chance to come to grips with flipping sheets of paper, operating the glass platen, and triggering each exposure without having to worry, at this stage, about shifting the finished cel and BG (background) artwork beneath the lens to create camera movements.

THE PENCIL TEST

From the comfortable perspective of a twenty-first-century production pipeline where every artist, technician, and manager has at least one computer monitor at his or her disposal, on which any part of the work-in-progress can be viewed as a moving sequence whenever required, it's hard to imagine what it must have been like for the pioneers of the medium.

Before neatly guillotined animation paper was available in standardized sizes, animators couldn't

even hold a group of drawings up to the window and flip through them to see how the movement was coming along. Winsor McCay's first solution to the problem of previewing his work in progress had been to fix the finished drawings into a cumbersome device, similar to the internal workings of the hand-cranked penny arcade machines that displayed sequential photographs of dancers or comedians.¹⁴

At the Disney studios back in the 1930s, only two "working" screens were available (outside the projection theater) to the more than a hundred creative and administrative staff members. The screens in question were back-lit rectangles of frosted glass about the size of a postcard, mounted in metal casings on the top of upright film-editing machines known as Moviolas. Of course, you only got an image onto one of these tiny screens by shining a light at low level through a sprocketed roll of film, and the only way to get an image onto that film in the first place was to send the line artwork to be photographed by the test camera department.

Nor was the resulting image identical to the one created on paper. In those days, if you wanted to view a positive (black-on-white) line image, you had to pay for two separate lengths of film: the original negative that ran through the camera, and the positive copy which, if requested, would be struck from the processed negative by the film lab on a separate length of film stock. To get around this double expense, animation studios either could trust to luck (and the animator's skill) by bypassing the photographed pencil test altogether or, if they wanted to preview the animation at the rough or clean-up stage before having it inked and painted for the final shoot, they would simply ask the lab to send the original negative back to them after processing, and that negative itself would then be run through the Moviola.

In those instances where the character line artwork was exposed over any kind of background drawing, this artwork would, of course, also register as a negative image, unless a film positive was requested (and paid for), and any shading or rendering on a scenic drawing would be likely to confuse since it would appear on screen as the inverse of the artwork's true tonal values. In some scenes it was important to show the positions of objects relative to the characters so that framing and registration issues could be addressed, but at the pencil test stage, there was little advantage in including anything other than the basic outlines of any environmental elements.

VIDEO AND DIGITAL LINE TESTING

Though a studio the size of Disney or Fleischer could afford to dedicate smaller cameras for the specific purpose of shooting pencil tests in the 1930s, for several decades the real-time moving image was a luxury item for which everybody had to wait, sometimes until the next day, depending on the bath times at the lab.

By the mid-1980s, video line-testing equipment had begun to provide a fast and affordable alternative to sending character line artwork to be shot on film by a rostrum camera operator. The resulting moving images, however, were still not something you could see in replay on any desktop in a studio the moment the rough drawings for a scene had been electronically captured. Even at this late stage, the rough-and-ready methods of the 1930s had not completely died out, as character animator David Burgess told me:

My second job out of art school was at a little commercial studio in Montreal, and because it was such a small place and there were only a handful of animators, when we were doing our Leica

reels¹³ we'd shoot our artwork downstairs in the basement where they had a 16mm Bolex, and we would actually develop the film ourselves. We'd go into this little dark room and develop the film in cans, then we'd come out, shake it around, dry it off, and then put it on the flatbed to see what was going on! And it doesn't get much more hands-on than that, I don't think.

In London in the 1970s John Leatherbarrow was still using much the same approach:

As a last resort we used to have a bucket and we'd actually shoot the line test on black-and-white film and then develop it ourselves, in the bucket! "Dip tests," we called it, because we had to dip it in the bucket!

It's important to appreciate that the purpose of an animation pencil test is purely to identify problems in the timing, the performance, and the quality of the line artwork. Consequently, most character and special effects pencil tests are shot without any scenic elements being shown and without any attempt at creating the required camera movements for a scene, even today.

In the predigital era, the cameras that were used to capture line artwork for stop-frame videotape pencil tests were fixed over the simplest of tables or light boxes with a single peg bar that would usually be moved, repositioned, and fastened down with masking tape every time another scene was shot. But, as Dave again recalled, even with the eventual streamlining of the computer age, there were limits to how fancy you could get at the pencil test stage:

Once we had pencil test computer systems in our offices, we'd have our peg bars and we could throw

down our copy of the background layout onto the top pegs and we could backlight and we could rough in that sense of what was happening with the camera: where the background was and where the characters were, and we could use our sliding peg bars to hack something together. But that tended to be much more on the fly. We weren't really committing to anything other than what looked good at the moment. And heaven forbid if you wanted to actually do a camera push-in or a pull-out by hand. Good luck!

ROUGH AND CLEAN-UP TESTS

Although in any one traditionally animated scene there may be several hundred separate character drawings and only two or three scenic components, the individual elements of a pencil layout are often far bigger than a single sheet of 12 or 15 field animation paper. For that reason alone, a do-it-yourself tabletop pencil test is out of the question. Even in the best equipped studios, space is usually at a premium and the precision of frame-by-frame movement required in order to execute a meaningful rough test of the hand-drawn environment artwork is really only available on the rostrum table itself.

Unlike the animators, whose primary concern is with the movement of the characters, the layout artists need to confirm that their background designs frame the performance properly, and they also need to check whether the timing and trajectory of the camera moves they have designed are working as intended. They can't, in short, shoot their own rough film or video test of the BG layouts because the success and effectiveness of their work can only be judged once the scene has been accurately photographed by the camera department, exactly as it will be in the final full color version, as Tom Baker makes clear:

Back in the film days, the rough pencil animation would be combined and photographed with the layouts during an official rough pencil test, so the layout artists did get to see how their perspectives worked with the rough animation.

Before painting began they got to see their clean-up layouts again on the clean-up test, which might also have some effects and cleaned-up animation in it by that stage. Eventually the scene would be shot a third and final time with all the elements fully painted and with the special effects being accomplished through backlight, split exposures, or burn-ins.

To send everything downstream *without* checking to ensure that all the noncharacter elements are working as intended could, of course, have disastrous and costly results. Consequently, through all the different stages in the development of camera technology, a rough test has been an essential step in the production process. As Tom recalled:

Even the smaller studios shot a minimum of one complete rough test with rough animation and rough layout artwork. They would usually bypass a clean-up test and settle for seeing everything cleaned up and painted in the final color shot under camera. So everything was shot a minimum of two times. Even independent studios that produced commercials always did one complete pencil test before cleaning up animation and painting the backgrounds. Only the smallest independents saw their animation over layouts for the first time at the final stage.

Before there were desktop computers with powerful processors and graphics cards capable of

high-speed, high-resolution image rendering, test photography in animation was a costly business, which makes it all the more astonishing that, in the early years of the medium, anyone would have wanted to complicate things even further, not only by increasing the number of flat levels of character and scenic artwork, but by pursuing a “theatrical” third dimension.

And yet, before Disney and his artists had been able to consider trying to match what Winsor McCay had proved to be possible in terms of cartoon draftsmanship, even in a short movie, more applications had been turning up at the U.S. Patent Office, some of them seeking ways of introducing genuine physical depth to the photography of moving hand-drawn images.

Endnotes

1. See glossary.
2. Precursors to the Oxberry camera stand.
3. A term used to describe the specially machined tabletop on a rostrum camera stand, which included the hinged platen glass and the gear systems that controlled the lateral movement of the peg bars.
4. The movie cameras that Technicolor developed for photographing live-action worked by exposing each of the primary colors—red, green, and blue—onto a separate strip of film negative. For this reason, they required a large metal case to enclose the additional reels. The cameras that were designed to photograph animation artwork in Technicolor at Disney achieved the same division into primary colors by means of a rotating disc fitted with the necessary filters, which allowed each frame of cel and background artwork to be photographed three times, once through a blue filter, once through red, and once through green. The resulting images were captured on three separate, successive frames of the one strip of negative film stock, thereby reducing the size and weight of the camera body. Both versions of the system involved the three separate primary images being recombined for the final, full-color positive film print.
5. The terms “field” and “frame” are sometimes used interchangeably.
6. See glossary.
7. Meaning the camera remained stationary, capturing a fixed rectangle of artwork.
8. The term “camera mechanics” refers to the required measurements for the angle, duration, rotation, and trajectory of any camera move, as planned and calculated in advance and as noted down on the camera guide diagram and in the “Camera Instructions” column of the exposure sheet.
9. See glossary.
10. See glossary.
11. Complex shots that require the greatest amount of work to accomplish.
12. For a more detailed description of this apparatus, see John Canemaker’s *Winsor McCay, His Life and Art* (Harry N. Abrams, 2005).
13. See glossary.

3

**A WORLD
ON A
PIECE OF
PAPER**

Because they were familiar with the architecture of the theater, early movie audiences knew there was open physical space behind the flat projection screen. Even later purpose-built cinemas were often designed with sufficient stage space beyond the screen to house live performances. When an audience sat in the dark, watching projected images of real people filmed in outdoor locations or of actors performing on the day-lit sets of a dusty studio lot, the bright illusion simply dissolved any sense of the flat screen in front of them as an impenetrable solid surface.

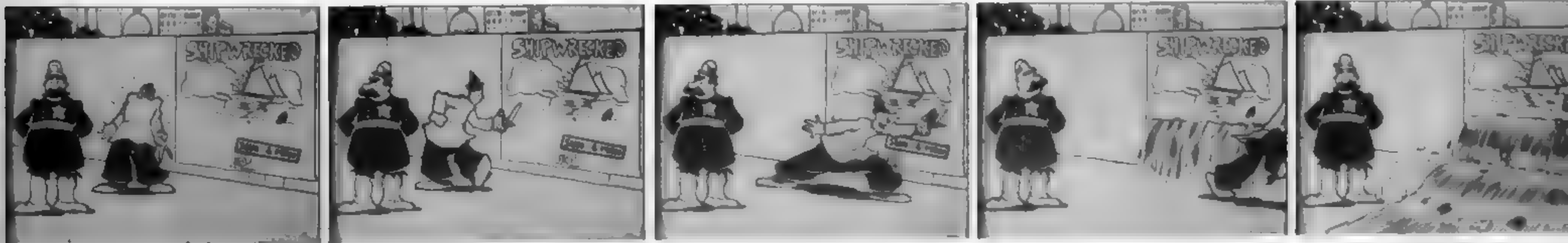
Because they were, by nature, showmen, both Winsor McCay and Max Fleischer wanted their hand-drawn creations to have equal access to exactly the same kinds of landscapes and performance spaces that their living counterparts enjoyed, but live-action movie photography was rapidly becoming a harder and harder act for cartoonists to follow. Slow-reacting photosensitive emulsion meant that early live-action cinema was very much an outdoor business and some live-action directors, perhaps seeing the fairground rather than the theater as their closest competition, were only too happy to take more of an open-air thrill-ride approach, attaching their cameras to moving trains, motor cars, and airplane wings—but how many thousands of artists might it take to duplicate the wild shifts in pictorial perspective that could be captured automatically by such daredevil photography?

At the time, the illusion of even simple movement in a cartoon could only be captured with a stationary camera. Initially, then, McCay, Fleischer, and their contemporaries chose to acknowledge and play with the very notion of the two-dimensional surface onto which their images were projected. The ability, either of a live performer to “enter” the screen or of an animated character to “escape” the page, fascinated both the cartoonists and their audiences. The very novelty of the medium, together with the appeal of everyday materials suffused with life and personality, combined to form the basis for a recurring series of visual puns, many of them simple extensions of long-established slapstick routines familiar to any vaudeville audience.

As he honed his performances over the years, Winsor McCay created an animated self-portrait that appeared on the screen with Gertie after he himself had stepped into the wings of the theater.

In their popular *Out of the Inkwell* series, Max and his brothers spun all manner of routines around the fact that their clown character Ko-Ko was able, at will, to escape the real world for the safety of the page—and vice versa.

This open acceptance, by audience and filmmaker alike, of the very mechanisms by which the “moving drawing” illusion worked carried with it a very real danger: the danger that the medium itself might simply become part of an ultimately inescapable recurring gag. Certainly, if they were going to make efforts to build and furnish cartoon worlds in which their characters would seem comfortable on their own terms without constantly having to accept or draw attention to their unreality, they would, like all illustrators, painters, and theater designers before them, have to accept that all perspective-based illusions of depth and solidity depend on a single held vanishing point. Cause your camera to rotate about either a horizontal or a vertical axis and the illusion is immediately lost. The film plane has to stay parallel to the artwork. Fortunately, in a regular theater every element of design and performance also has to play toward the collective “eye” of the auditorium. Seated in the most expensive seats, which are to be found in the front row at the center of the first balcony, the closest point in the auditorium to the center of this imaginary eye, the viewer is in the optimum position to enjoy the clearest illusion of theatrical

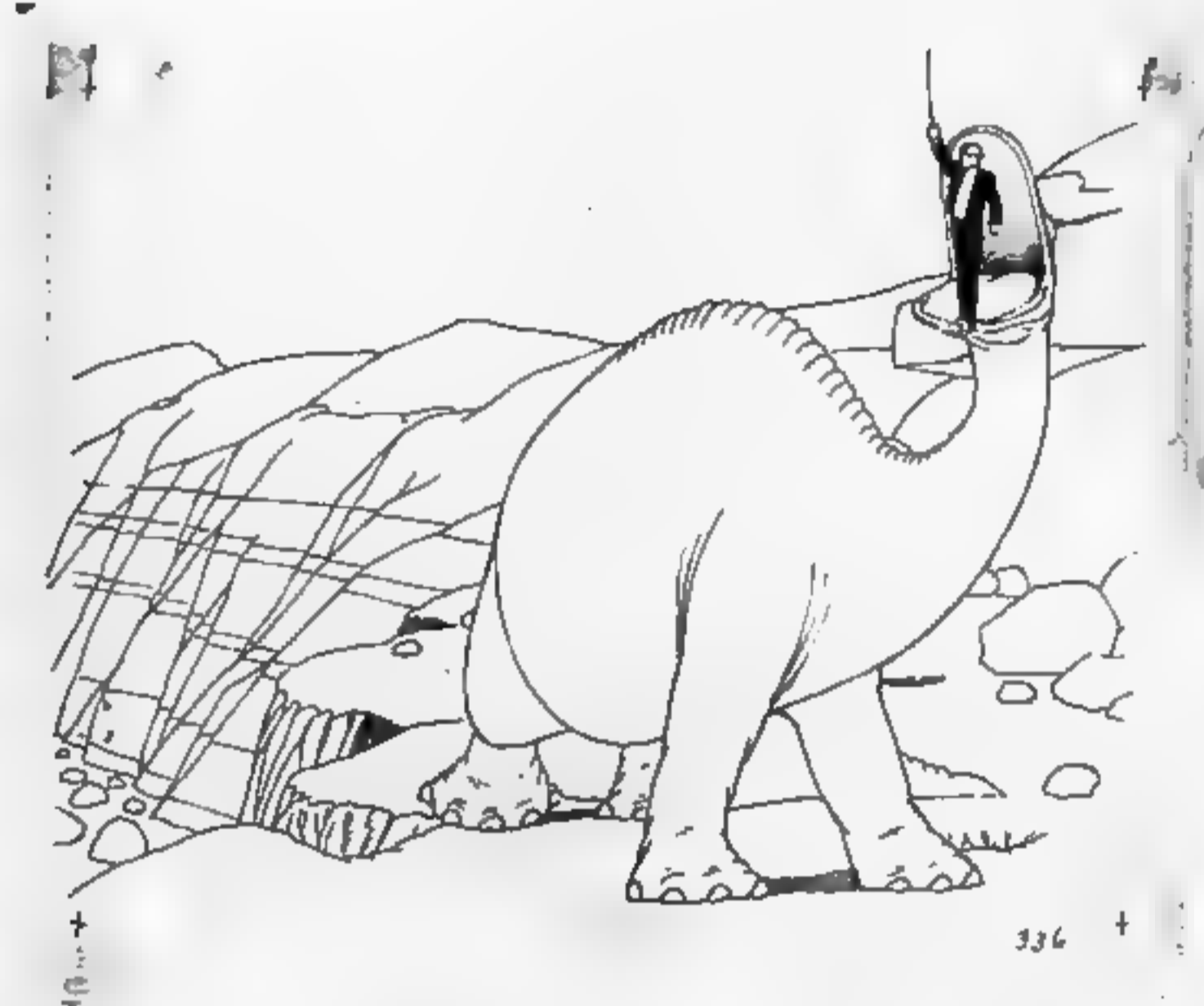


PREVIOUS, LEFT: In the early years of cinema, the on-screen performances of animated characters were often developed (or copied directly) from well established Vaudeville routines; theaters therefore provided the setting for many early animated shorts. 12 Field master production background, ink and wash "Silly Scandals" (1931) Max Fleischer's Talkartoons Directed by Dave Fleischer & produced by Max Fleischer

PREVIOUS, RIGHT: In the Fleischer brothers' *Out of the Inkwell* series, all flat surfaces could be torn, punctured, or pierced, thereby becoming makeshift gateways into another dimension; in this case Ko-Ko releases a torrent of ocean water into a narrow alleyway by cutting into the poster image of a shipwrecked boat with a pair of barber's scissors. *Ko-Ko the Barber* (1924) Directed by Dave Fleischer & produced by Max Fleischer



TOP, LEFT: Background elements in many of the Fleischer brothers' short films were added "live," either by Max or with Ko-Ko himself wielding the pen; in this example Ko-Ko "escapes" instead into a painting on the studio wall, only to be recaptured with an eye-dropper by Max and returned to the ink bottle. *The Chinaman* (1920) Bray Studios Inc. Directed by Dave Fleischer & produced by Max Fleischer



TOP, RIGHT: In one of the few surviving original pen drawings from *Gertie the Dinosaur* (1914) the animated Winsor McCay is pictured, triumphantly brandishing a ring master's whip, in Gertie's open mouth. *Gertie the Dinosaur* (1914) Directed by Winsor McCay

perspective. Conversely, the farther away from this central hot spot we move, the more we have to make allowances for everything from glimpses of chalk marks on the wooden boards of the stage floor to the conspicuous fakery of the scenic flats suspended in the wings.

Only flat artwork elements rendered on cel, paper, or board *could* be pressed against a horizontal surface such as the "compound" table of a rostrum camera in order to be photographed. With registration holes punched at the top of some items and at the bottom of others, the camera operator could move separate flat levels of artwork in opposite directions against one another on separate peg bars beneath the lens. Finely calibrated gear wheels and rulers provided a control system for these lateral, frame-by-frame movements, which could also increase or decrease smoothly in tiny increments.

The technique was most commonly used to pan (move panoramically) a piece of scenic artwork behind a series of cels on which a repeating cycle of images had been painted, representing the full stride of a walking or running character. This allowed the animator to draw the character walking "on the spot" in profile but required careful measurements of the distance between footfalls since the character's feet had to remain locked to the background artwork as it moved sideways frame by frame at the chosen speed.

Until the mid-1930s all these techniques remained confined to the photography of flat levels of animation artwork, pressed against one another in a flat sandwich beneath the platen glass. Gradually, however, various animators began experimenting with techniques that might allow them to introduce real physical space between these individual character and scenic components. The beauty of borrowing a theatrical approach to scenic design for use in moving cartoons was that the immobility of the cartoon camera perfectly



OPPOSITE BOTTOM Max and Dave Fleischer created an on-screen world in which every element could be either animated or transformed: ink came to life the moment it left the bottle and characters could step out of (or through) the page onto which they had been drawn.

TOPLINE (ALL BY *The Chinaman* (1920) Bray Studios Inc.

MIDDLE LEFT *Ko-Ko Nuts* (1925)

MIDDLE CENTER *The Tantalizing F* (1919)

MIDDLE RIGHT *Ko-Ko Battles the Bulls* (1926)

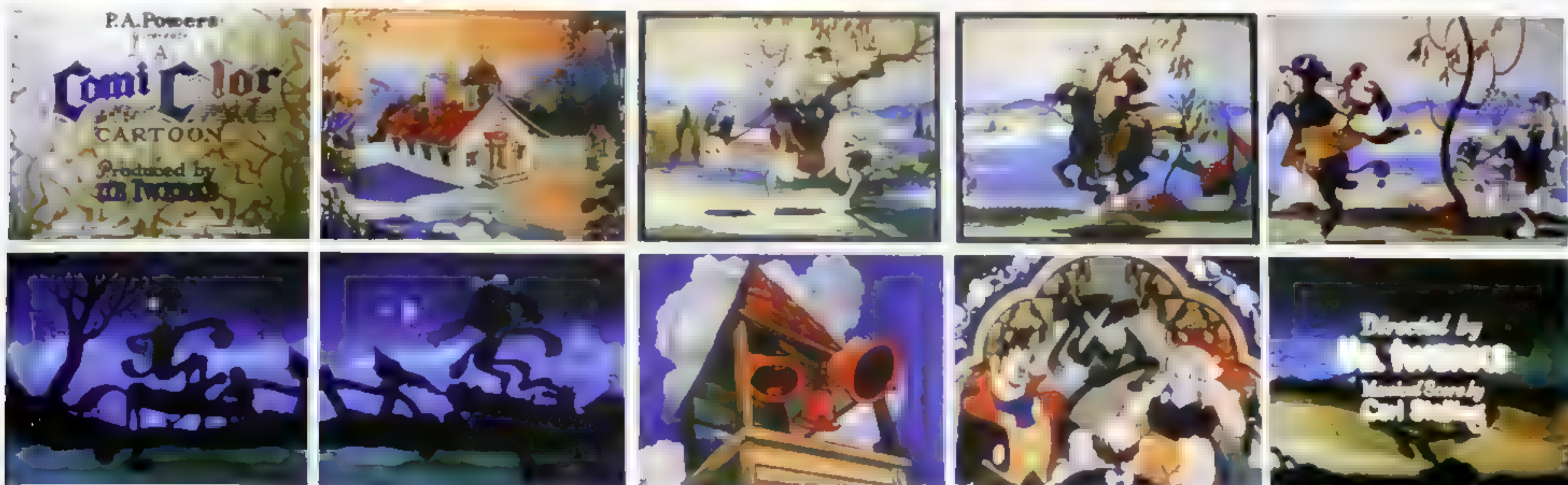
BOTTOM LEFT *Ko-Ko Trans-Um* (1925)

BOTTOM CENTER *Ko-Ko Battles the Bulls* (1926)

BOTTOM RIGHT *The Chinaman* (1920)

All titles directed by Dave Fleischer & produced by Max Fleischer

BELOW: Montage of frame enlargements from *The Headless Horseman* (1934), directed by Ub Iwerks; Iwerks's pioneering multiplane camera allowed two or three separate levels of scenic artwork to pan behind the character cels at different speeds, providing an unprecedented sense of depth and perspective in the shots where Ichabod Crane rides from right to left in daylight and is then pursued in the opposite direction by the Headless Horseman at night.



matched the immobility of a theater audience. So instead of being compacted together into a single horizontal plane on the tabletop beneath the lens, why not suspend the different artwork levels vertically and allow them to separate out like flats on a theater stage, then reorient the camera to photograph them? That way the characters could appear to inhabit theatrical (as opposed to merely pictorial) perspective.

Having been in a working partnership with Walt Disney since 1919 when the two first met as junior commercial artists in Kansas City, Ub Iwerks, the codirector of *Steamboat Willie* (1928) and creator of the original design for Mickey Mouse, decided to leave Disney in 1930 to establish his own studio. Though he was eventually to rejoin his old partner ten years later, Iwerks, a self-educated renaissance man with a mechanical as well as an artistic flair, designed and built just such a horizontal rig, putting it to use for the first time on his studio's *Headless Horseman* short in 1934. I asked Ub's son, Don, about his father's pioneering design for a multiplane animation camera and

about the popular myth that it was constructed entirely from odds and ends, including one or two automobile parts:

I don't really know much about my father's multiplane except that it was a horizontal stand. He knew what it would take to build something, and I think there were probably some parts of it that were automobile parts; he was very clever in terms of adapting things to make it work. Didn't make much difference to him what it looked like, as long as he could make it work. His multiplane preceded the ones at Disney so some of his early cartoons had multiplane scenes in them, and certainly while he was away from Disney, Disney must've caught on to that, recognizing that this would be good to have. But they designed their stands to be vertical, which in the end makes more sense because the artwork's all laying flat and it's a little more workable.

Ever since McCay and Hurd had hatched the idea of drawing on clear cels, it had been possible to see past animated character levels through to a flat background so, if interesting effects could be achieved using the Iwerks method of photographing multiple levels of flat artwork, why not go one step further and let the camera (and the audience) see past the characters to a miniature 3-Dimensional theater set? In 1933 Max Fleischer filed for a patent, granted in 1936, for a device which did exactly this:

Cartoons made according to present practices depend for their illusion of distance on the manner in which the background is drawn or painted by the use of commonly known perspective rules and regulations, and although this indicates distance to the observer, it does not actually give the observer a sense of true distance. This same fault is apparent in animated cartoons with respect to the relation of the character or action to the background, and between various portions of background that are intended to be at

With the individual character cels positioned closest to the lens, three separate flat levels of scenic artwork were moved sideways as each frame was exposed, the increments of these movements being smaller the farther the artwork was from the camera. Following a technique that is still in use today, the animators broke the background artwork into sections that could "repeat" endlessly; as each peg-registered section passed beyond the edge of the frame it could be moved back and reintroduced on a separate sliding peg bar behind the character cels. The hero and the villain even have their own distinctive passing background elements associated with them.

OPPOSITE, A: The dark perspective lines of a moonlit cornfield draw the eye toward a giant full moon appearing over the horizon in this 1933 watercolor background.

12 field master production background
Betty Boop's Halloween Party (1933)

Directed by Dave Fleischer & produced by Max Fleischer



a Having fallen asleep in front of a large stone fireplace, Betty Boop dreams that the hearth has been transformed into the gateway to a fiery underworld.

12 field master production background

different distances from the eye of the observer; notwithstanding the skill employed in making the drawings, and the flatness of these cartoons gives them an artificial character that, to a large degree, impairs their effectiveness.

In the documentation for his patent application, supporting an invention that he believed would help in the creation of panoramic pictures, Max Fleischer made clear the range of practical movie-making problems he hoped to overcome. But the wording also hints at an increasing sophistication in film continuity and editing techniques:

In the cartoon of today it is frequently necessary to depict close-up views and distant views as well as views giving the illusion of the observer approaching, and in other cases, receding from the action and background. Each such change in the apparent position of the observer produces a change in perspective and consequently relative changes in the component parts of the composite picture with relation to each other. These changes which must be depicted to secure realistic effects are wholly lacking in the present methods of making cartoons and are only possible by those methods by making innumerable additional drawings, the cost of which would be prohibitive.

The changes Fleischer describes in the “apparent position of the observer” are cuts from one shot to another, and the “relative changes in the component parts of the composite picture” make clear the challenge to artists charged with creating background imagery that will frame the action and support the story without distracting from either, especially through faults in the rendered perspective.

Fleischer’s horizontal tabletop design addresses these problems by suspending the cels carrying the

c By rendering the grotesque faces of the transformed fireplace on a separate “overlay” level, a “dissolve” can readily be created between the “regular” and the “nightmare” versions of the painted artwork.

Overlay for 12 Field master production background

Key: Mad Mummer (1934)

Directed by Joseph Fleischer & produced by Max Fleischer

line artwork vertically in front of 3-dimensional miniatures. Not only does the suggested method spare the scenic artists the frustration of creating unsatisfactory perspective “cheats” in the rendering of flat background artwork, it allows for variations in the color and angle of any light striking the model set:

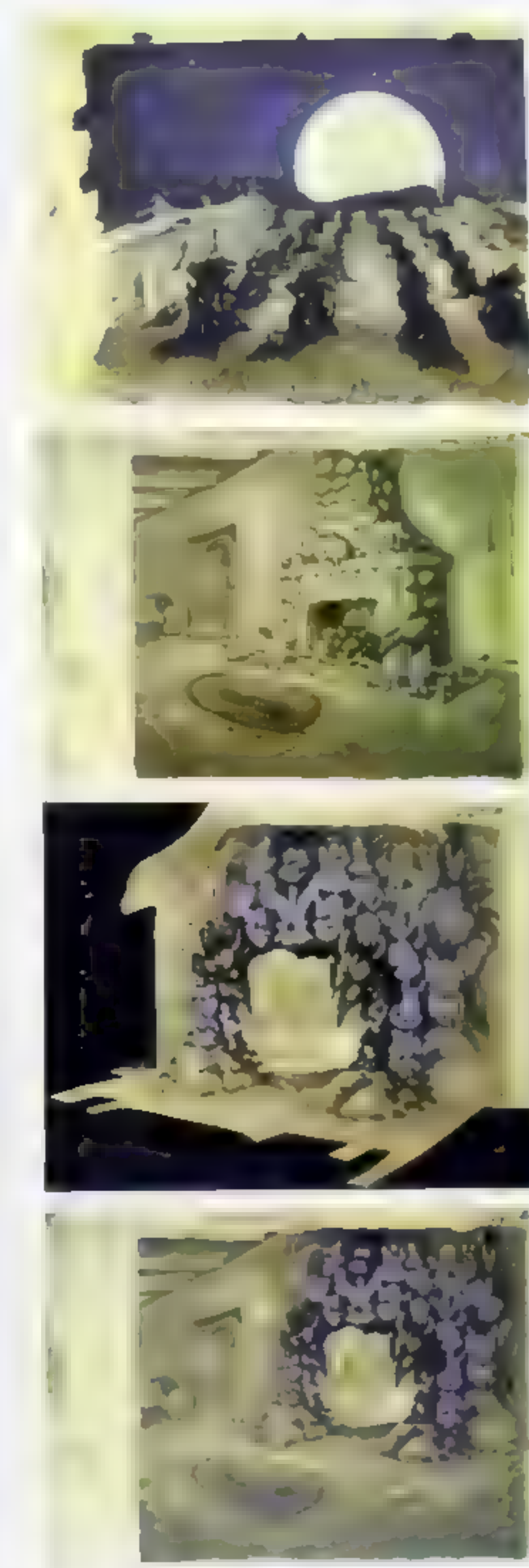
The present methods of making cartoons are also severely handicapped in securing proper relative illumination of action and background and various portions of the background, independent illumination being impossible or impractical, and to secure contrasting illumination, dependence is almost entirely placed upon the drawings themselves.

Here, if you like, is our first documentary evidence of the role a cartoon background artist has to play in creating the lighting for a moving picture using nothing more than the observational and illustrative skills learned in the open air and at the drawing board. But no sooner has our draftsman-cinematographer appeared than somebody is trying to force him or her out of a job by sowing the seeds of dissatisfaction with 2-dimensional artwork, and sweeping their skills aside in favor of the model-maker.

Ray Pointer is one of many to lament the unrealized potential of this ambitious technique, developed by the Fleischers along with their cameraman, John E. Burks:

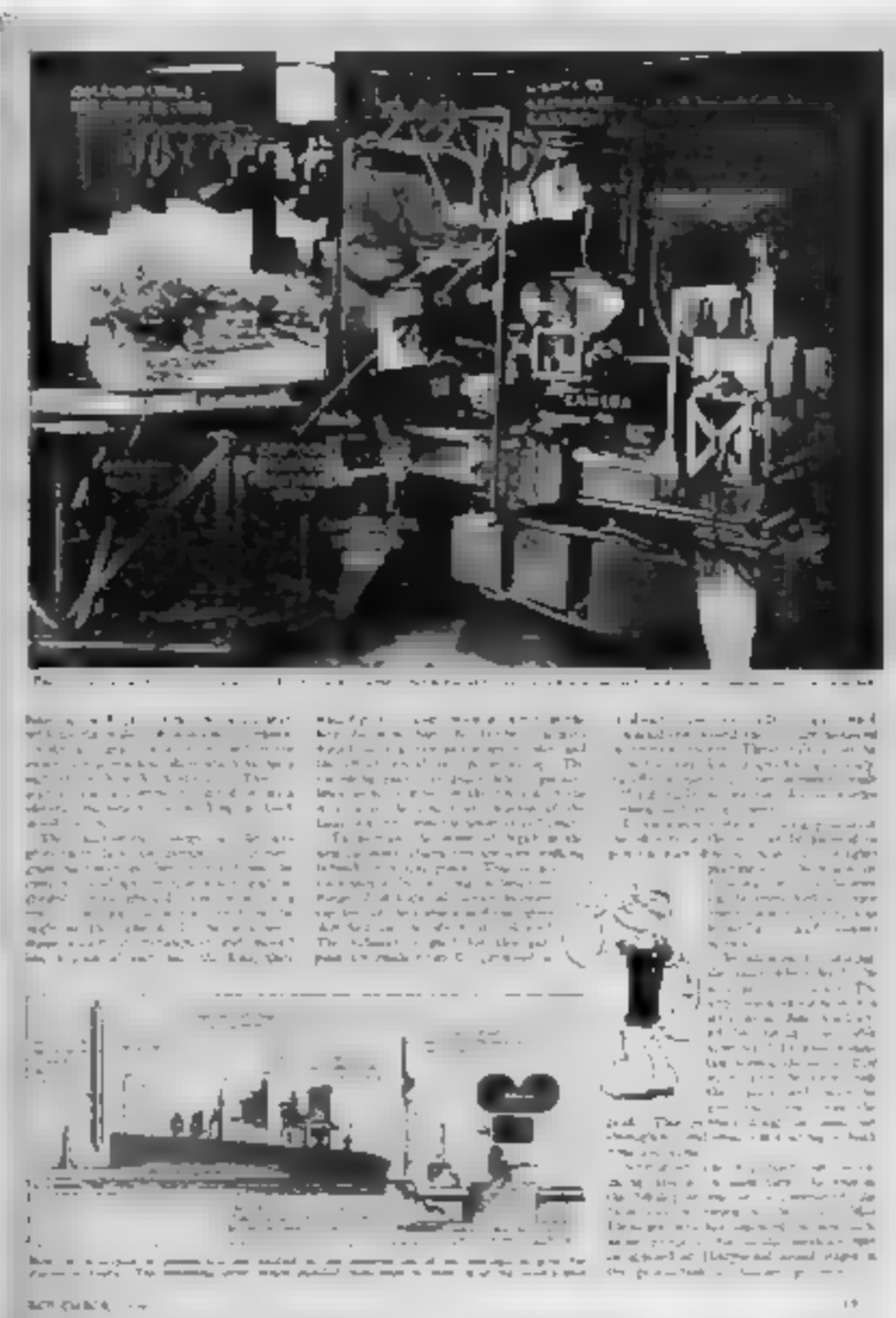
The camera setup for the dimensional separation was used in perhaps two of the later *Superman* cartoons, possibly only twice. Certainly when we have the shot going through the window of the Daily Planet building in the first one [*Superman, a.k.a. The Mad Scientist, 1941*] and one other similar shot in *The Bulleteers* where it looks like something similar was done. Other than that the

d The hearth rug remains visible but the fire surround and the coal scuttle are both obscured when the “overlay” element is positioned on top of the original background painting, creating a direct pathway and beckoning Betty Boop through to the underworld.

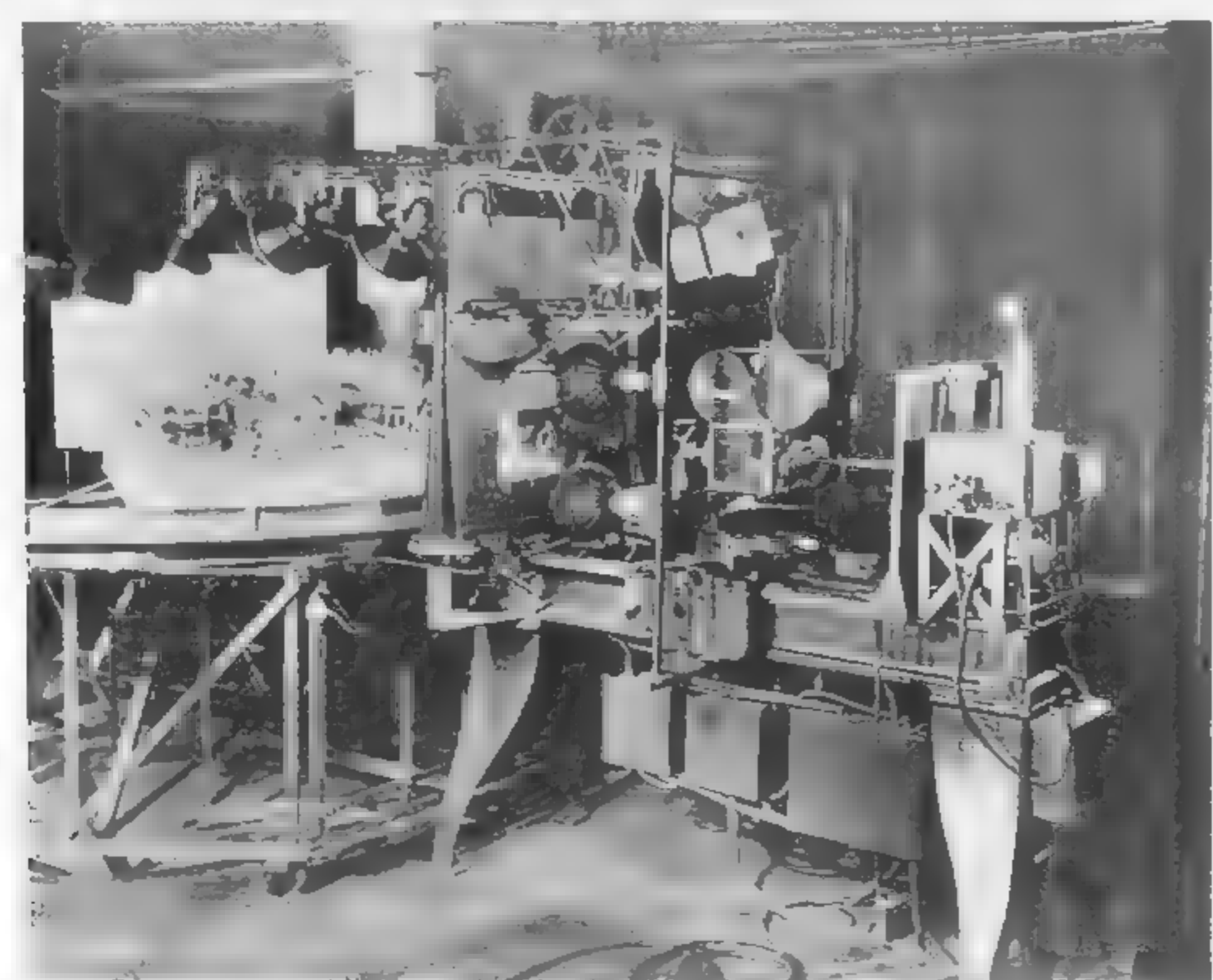


TOP, LEFT: At the end of the twentieth century, 3D became industry shorthand for any computer-modeled (as opposed to hand-drawn) object or character; by the beginning of the twenty-first century, 3D once again meant the photography and projection of a truly stereoptical version of a movie; here we see how, in the late 1930s, the term "stereoptical" was being used by the Fleischer brothers to indicate the photography of flat cel animation in front of solid miniatures.

Opening page of a *Hobbies and Inventions* article printed in *Modern Mechanix* magazine in July 1936



BOTTOM: The Fleischer "stereoptical" turntable camera in use during photography for a Popeye short. *Play Safe* (1936)
Directed by Dave Fleischer & produced by Max Fleischer



rest of them are all shot flat under the platen, and any dimensional effects that occurred, such as the one in *Mechanical Monsters*, were created using an OL/UL [overlay/underlay] setup with cutouts manipulated at a faster pan speed than the underlay. The closest they came to implementing it fully was in the two longer versions of the Popeye cartoons, *Sinbad* and *Ali Baba*. When I saw those shorts, I used to imagine what the impression would have been had that process been applied to a feature.

For many, however, there tended to be an unavoidable visual tension in the final image between the solid objects and the flat characters although, as Pointer argues, this tension was relaxed slightly on occasion by the choice of materials:

A couple of the photographs of works-in-progress show the papier-mâché setup with the railroad roundhouse from *Play Safe* [1936]. But those backgrounds would be made of many types of things; some of them would have been papier-mâché, but sometimes they might have used clay and sometimes it was a combination of those techniques.

Sometimes they actually had cardboard cutouts and it seems, as they got further into the use of them, the closer that they were to actually being flat cutouts the more successful they were, because they were closer to being a stylistic match to the flat-painted background.

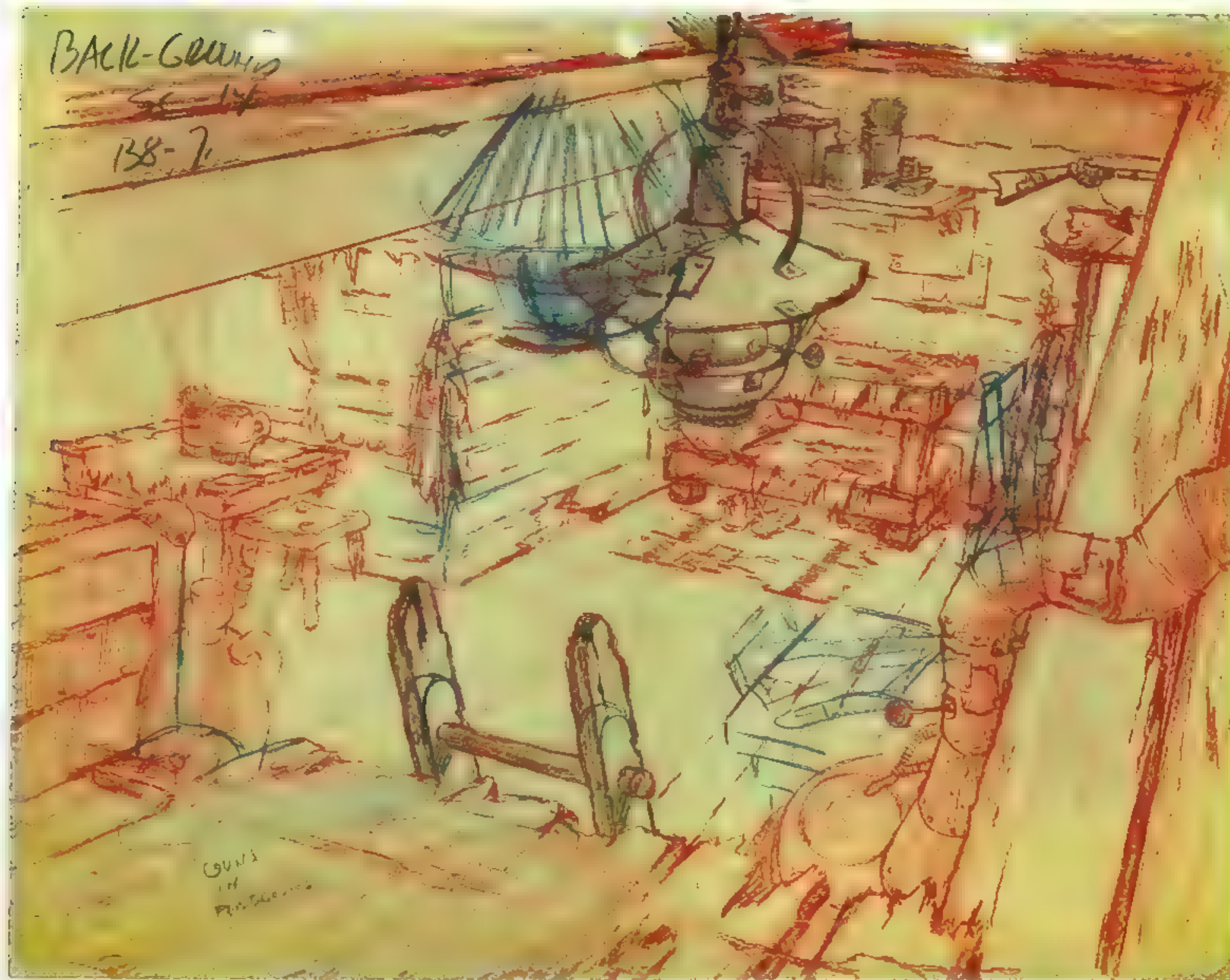
I asked Leslie Cabarga, author of *The Fleischer Story*, how successful he reckoned Max's "turntable" device had been, given the fact that the physics of 3-dimensional reality was inevitably going to collide with the realities of the 2-dimensional rendering of the characters on the cels:

In this drawing for a 1939 Betty Boop short, the simplicity of an earlier rough line (drawn in blue) has been reworked in far greater detail without altering the basic geometry or key registration points of the ambitious "down-shot" perspective.

Original 12 field BG layout drawing, artist unknown

Musical Mountaineers (1939)

Directed by Dave Fleischer & produced by Max Fleischer



In the Fleischer cartoons that featured the Set-back camera¹ it was very obvious, almost jarring, when those multiplane shots came on. At the same time as you're kind of marveling at it you're also going, "Hey! What's going on here?!" And especially when it would jar to a stop, you would notice it. So I think that the Disney people would most likely have been trying to avoid that same contrast.

"BY MENTAL AND MANUAL PROCESSES ALONE"

Harvey Deneroff, son of Fleischer animator Joe Deneroff and, like Cabarga and Pointer, a respected expert on all matters Fleischer, has suggested that both the Iwerks and Fleischer rigs were inspired by the rear-projection system Willis O'Brien created for *King Kong* in 1933 (and their diagrams seem to support this theory). Fleischer certainly filed his application at the end of 1933, the year *King Kong* was released, although the patent for his turntable camera wasn't actually granted until September 15, 1936.

Interestingly enough, Disney himself submitted a patent application on September 1, 1936, for a rostrum tabletop with a shallow recess cut into it. If we follow the example in the diagrams he provides and apply a certain amount of imagination, this table could be rigged to give the effect of a room interior. More than anything, Disney seems to have been eager to solve the problem of something I myself and the other members of the *Roger Rabbit* effects crew came to know as "contact" or "cast" shadows. Using the device successfully would mean that (in the words of the patent application):

Long before home video and DVD made "making of" footage readily available, cinema audiences could enjoy short documentary features that revealed the new techniques and processes being developed by the major movie studios. Here the camera operator arranges cels of Sinbad's giant pet Roc to be photographed against an (as yet unpainted) clay miniature of a mountaintop fortress, positioned in front of a painted backdrop of clouds.

One of the Fleischer Studios' camera operators at work on the "Standard Field Set-Back" camera during trial photography for the

Academy Award-nominated short, *Popover the Sailor Meets Sinbad the Sailor* (1936)
Directed by Dave Fleischer & produced by Max Fleischer



... accurate representations of shadows are obtained in a very minor fraction of the time which an animator would require if he was required to reconstruct the shadow by mental and manual processes alone.

It's difficult though not to feel your heart sink slightly as you read on:

Generally stated, the method of this invention comprises forming a three-dimensional model of the desired background, projecting the image of the foreground character upon such three-dimensional background, and utilizing the position of the character and its shadow with respect to the three-dimensional background in locating and representing the shadow of such character

in its correct relationship with said background upon the final drawing or photographic record.

In short, if you photograph your character cels on a glass panel positioned over the recess in the table, it ought to be possible to rig your lights so that the silhouette of the character, rendered in opaque paint, casts its own shadow over the miniature environment. The sample illustration Disney provides shows the studio's Clara Cluck character standing in a log cabin, holding a storm lantern.

With little disposable income available to them in the 1930s for investment in costly mechanical experiments, Disney and the resident engineers at his studio would seem, as Leslie Cabarga suggests, to have thought long and hard about the merits (or lack thereof) of the various devices being tried out

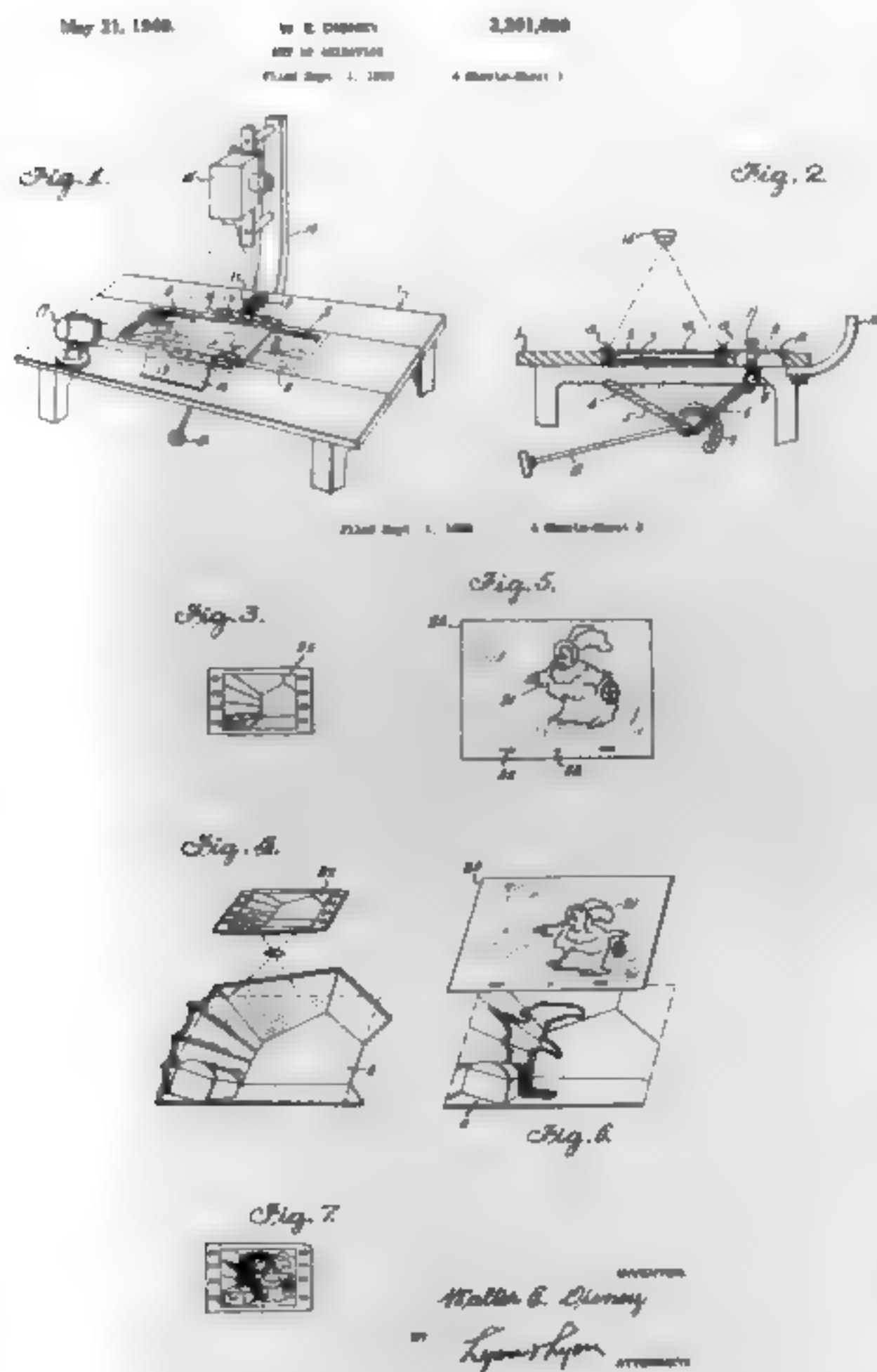
by the other studios. Moreover, they also considered the likelihood of any satisfactory solution ever being found to the perennially awkward problem of depicting flat, hand-drawn characters against 3-dimensional space, whether real or imagined. The only simple way to make a hand-drawn character appear to retreat into the distance is to make each subsequent drawing smaller than the last one, while attempts to make limbs or props project toward the audience require the kind of foreshortening which can all too easily seem conspicuous and distorted.

Disney's "chicken shadow" table certainly can't have been costly to build, because it involved only one level of artwork and the 3-dimensional component was so modest. Since we know the importance, ambition, and impact of what came next, it's

LEFT Diagrams from Walt Disney's patent application (filed 1936, granted 1940) for a modified animation camera stand intended to allow cartoon characters painted on cel to cast their own shadow on a simple 3-dimensional interior, recessed into the "compound" table beneath the camera lens.

RIGHT Photographs from the September 1944 issue of the monthly magazine *Popular Science* showing the camera operators at work on the Disney Multiplane "crane."

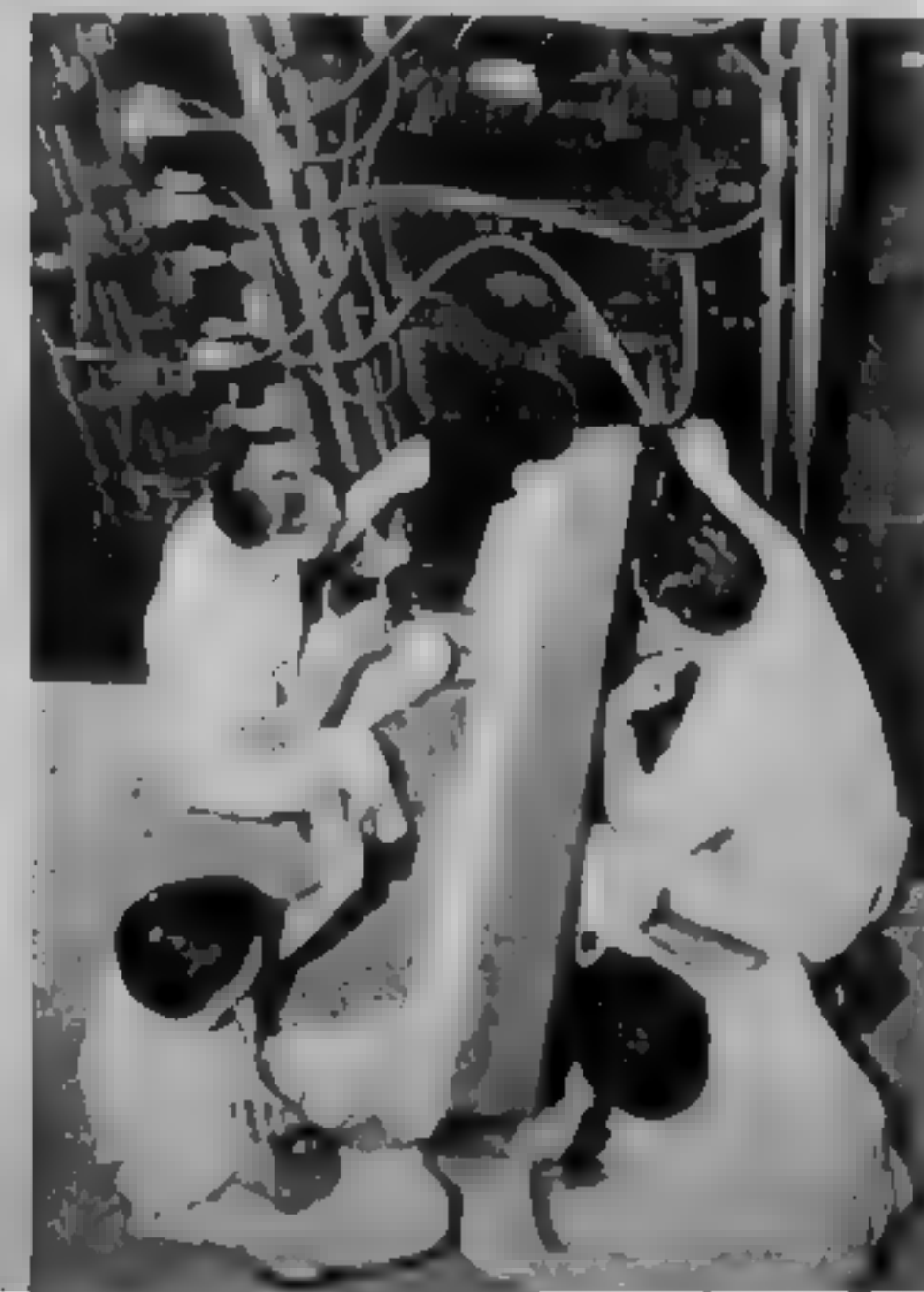
Popular Science, Vol. 145 No. 3



MULTIPLANE CRANE AND CAMERA GIVE REALISTIC DEPTH



This is the multiplane crane (left) that Disney developed to get the effect of distance in his two-dimensional pictures. A camera pointed down from the top photographs various parts of a scene at different levels, thus providing the third-dimensional illusion of depth. Picture below shows operators sliding a background into position in preparation for making the shot.



almost tempting to think of it as industrial sleight-of-hand, a deliberate decoy to throw his competitors off the scent of what was really being dreamed up over in the Disney engineering shed.

THE DISNEY MULTIPLANE CAMERA

It's impossible to stand anywhere near one of the three multiplane camera stands that were designed and built at the Walt Disney Studios without thinking of those quayside shots of characters in movies about to sail away on ocean liners. The sheer size of the enormous metal stand demands

that you step back in order to take in the outline, let alone ponder the intent of the thing. In those photographs where the operators themselves are pictured, they seem more like luggage porters than movie cameramen.

The original Disney multiplane camera stand was designed and constructed by studio engineers William E. Garity and Roger Broggie, Sr., for the photography of the studio's (indeed, the world's) first ever feature-length animated cartoon, *Snow White and the Seven Dwarfs*. Unlike Ub Iwerks's earlier horizontal model, it was built to work

vertically, with the camera lens pointing down at various levels of character cels, and scenic artwork suspended on heavy glass shelves, each of which was equipped with the same finely engineered sliding peg bars and incremental gear-wheel controls as a regular compound rostrum table.

A keen theatergoer since childhood, Disney knew and understood the difference between a vaudeville comedy sketch and a three-act drama: while it was acceptable for a theater audience to be diverted and entertained by a quick slapstick routine, a full-scale dramatic narrative had to

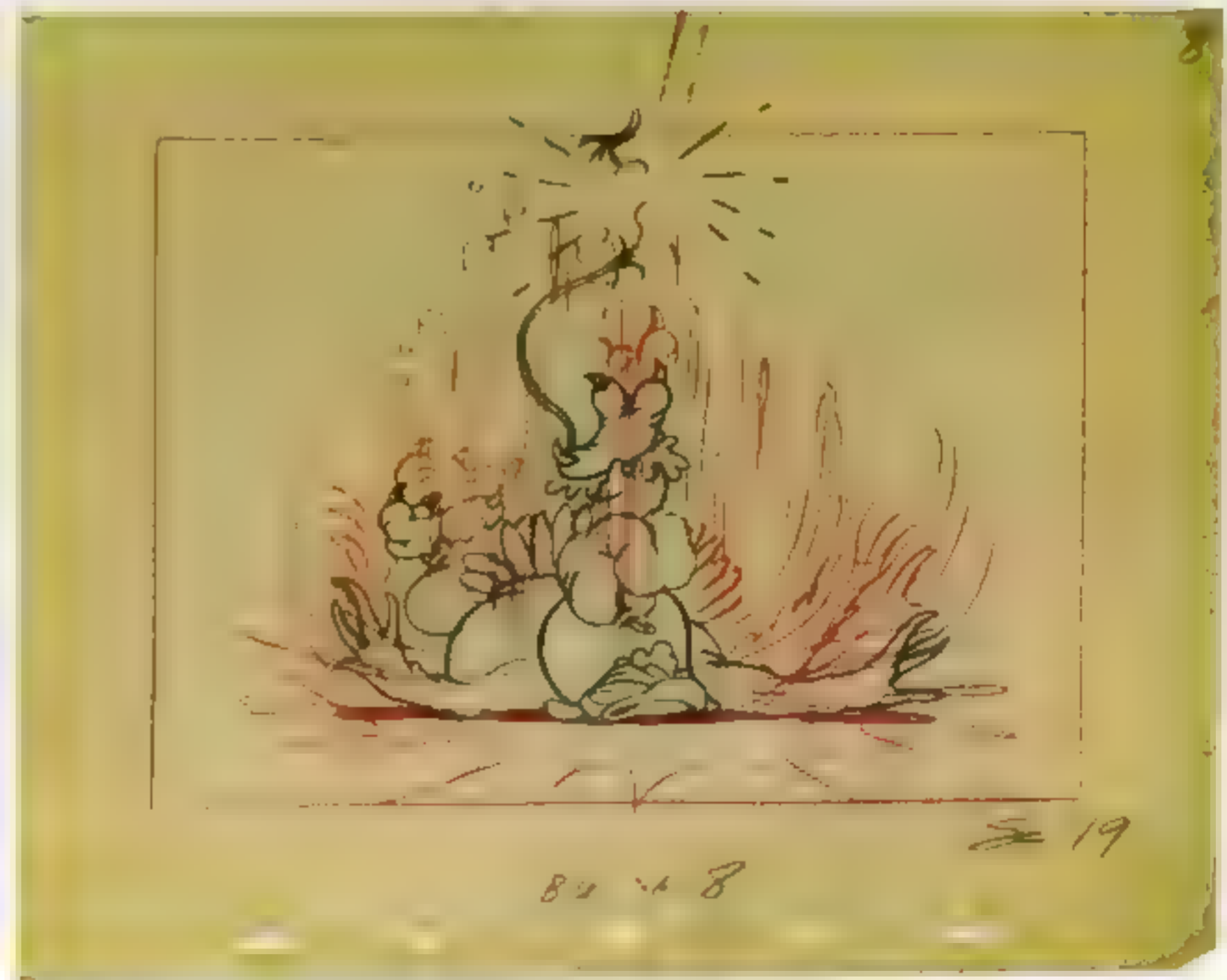
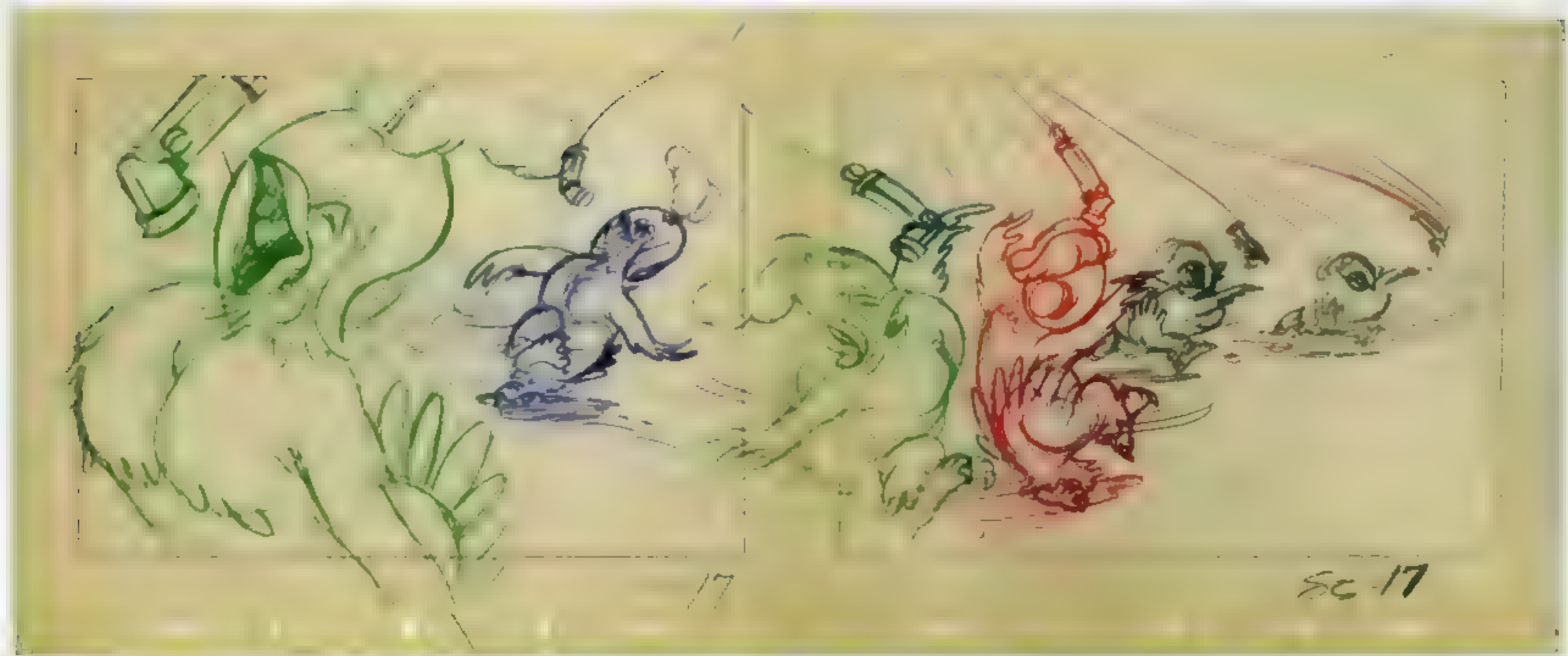
Different colors of pencil have been used to create the rough key positions for Clara Cluck in these character layout drawings; clear indications have also been given of the "dry brush" speed lines and prop elements that will be required.

Character layout drawings with holding (or camera framing) diagrams

Mickey's Amateurs (1937)

Directed by Pinto Colvig & Erdman Penner

Animators: Art Babbitt, Les Clark, Al Eugster & Ed Love



In close imitation of familiar, well-established vaudeville slapstick routines, much of the action in Disney animated shorts of the 1920s and '30s was designed to play out between the footlights and the fire curtain.

Character layout drawings with fielding (or camera framing) diagrams
Mickey's Amateurs (1937)

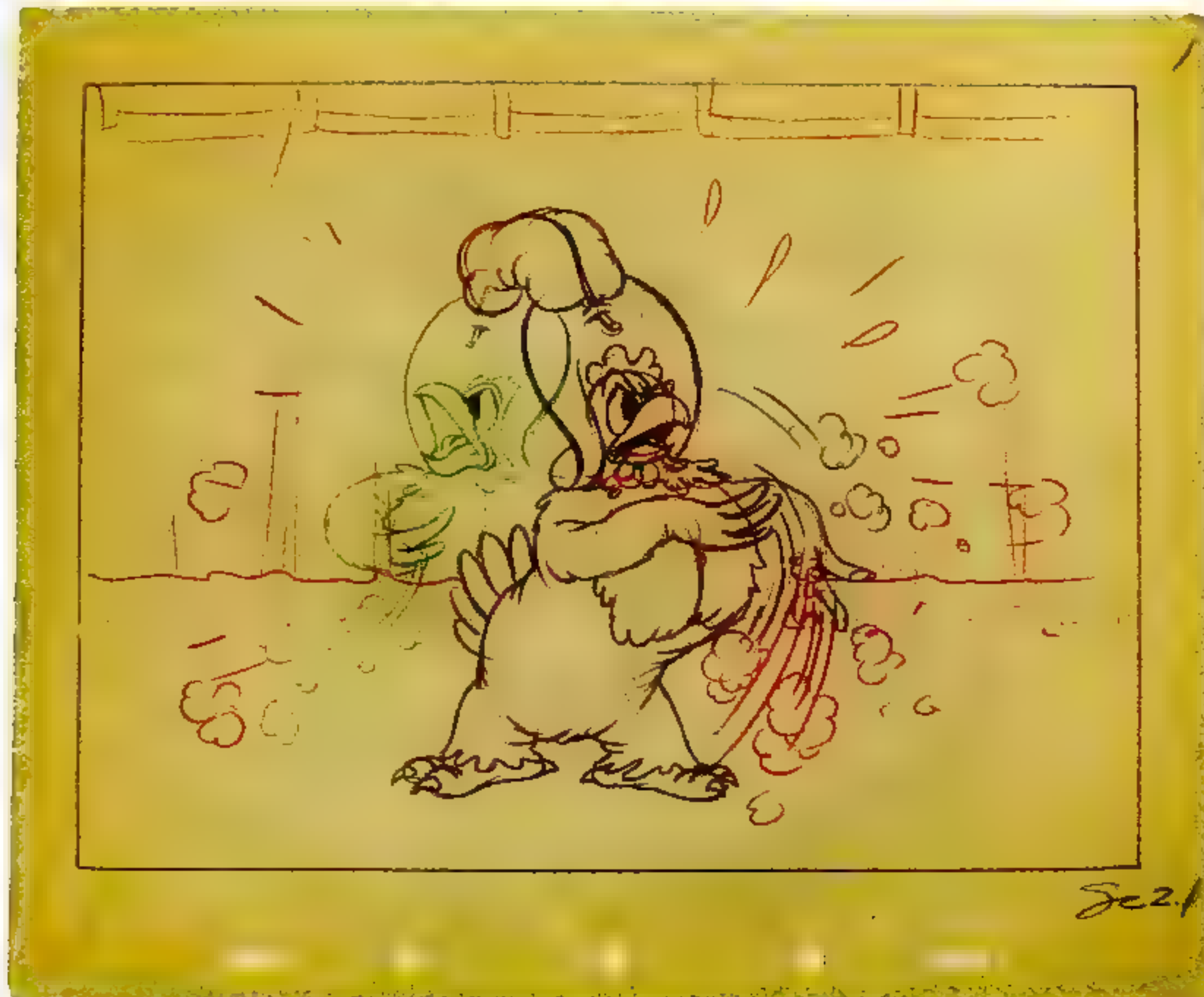
Directed by Pinto Colvig & Erdman Penner

Animators: Art Babbit, Les Clark, Al Eugster & Ed Love

FOLLOWING SPREAD, LEFT: Color markup and registration guide for
Goofy's trombone and other props.

12" x 10", graphite and colored pencil on animation paper
Scene 30, *Mickey's Amateurs* (1937)

Directed by Pinto Colvig and Erdman Penner



FOLLOWING SPREAD, RIGHT: Background layout drawing showing all the
instruments and controls for Goofy's one-man band.

12" x 10", graphite and colored pencil on animation paper
Scene 30, *Mickey's Amateurs* (1937)

Directed by Pinto Colvig and Erdman Penner

convince and involve them. If members of Disney's audience were going to identify with the characters and events in a feature-length movie, they would have to forget, at least for a time, that they were in a movie theater. There must be nothing about the images on screen that had the potential to break the theatrical illusion even momentarily.

Perhaps because his own attempt at devising a method for projecting the shadow of a flat character into the real physical space of a miniature set had proved unworkable in practice, or perhaps because he too had found the Fleischer "Stereoptical" technique interesting but ultimately distracting, the Disney multiplane stand, for all its bulk, was also designed exclusively for the photography of flat artwork.

Since Max and Dave Fleischer's first animated feature, *Gulliver's Travels* (1939), appeared only two years after *Snow White*, it's safe to assume that their own "Stereoptical" photography process may originally have been developed with feature production in mind. Ray Pointer refers to press clippings from the time that seem to support this idea:

There was an early publicity article in the *New York Times* that mentioned an intention to use the Stereoptical process on *Gulliver*, but it never happened. The only application of it was with the model city in the opening sequence of *Mr. Bug Goes to Town* [1941]. Other than that there's no real application of it in the features.

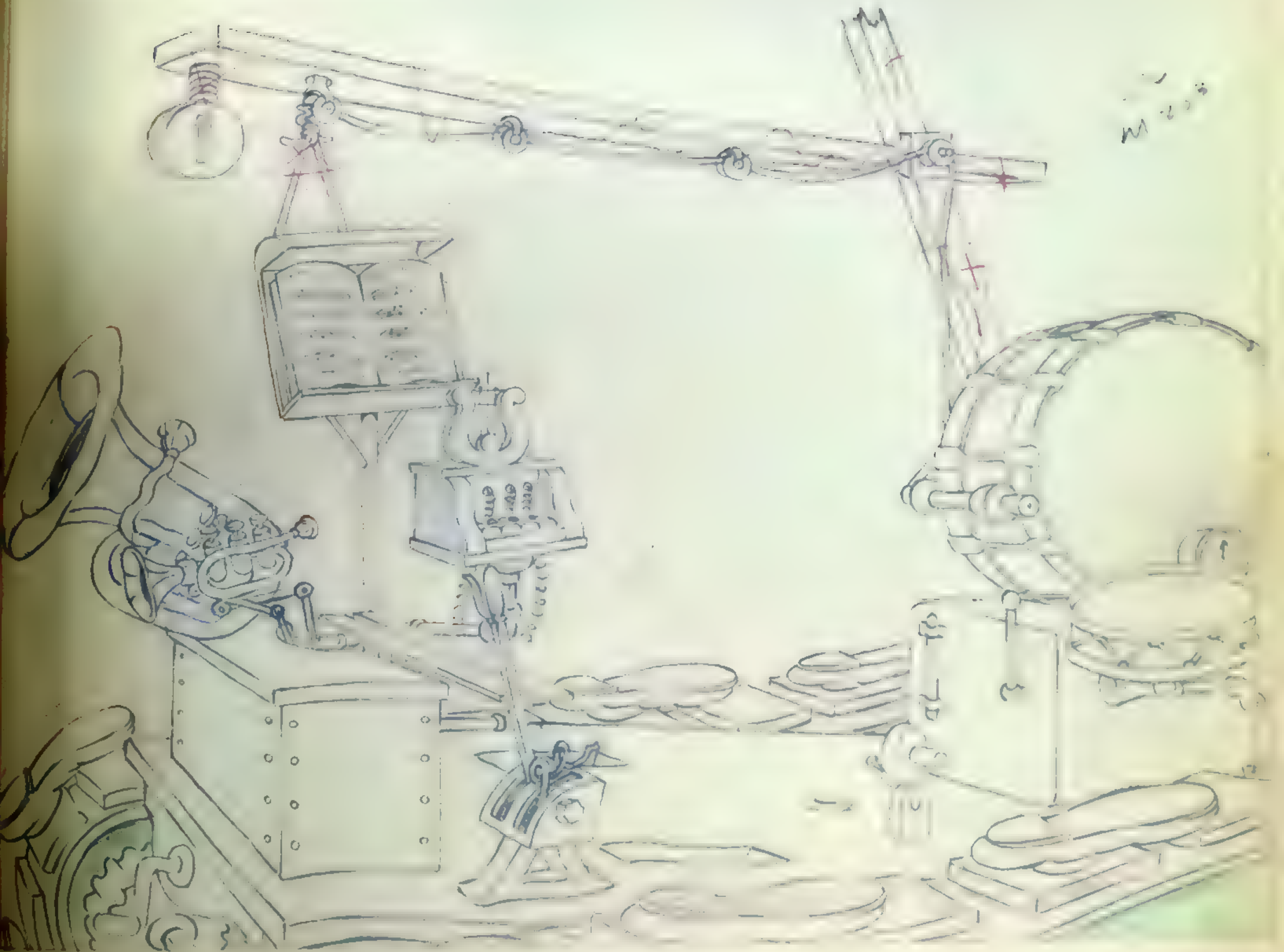
Although background artist Robert Little built and photographed the stunning miniature city on the ingenious rotating tabletop for the opening title sequence of *Mr. Bug Goes to Town*, the Fleischer brothers made no attempt in either of their feature-length cartoons to integrate 3-dimensional models or props with the flat cel character animation.



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LEFT: Dave Fleischer operates a gearwheel of the rotating turntable on which the studio's "Scenics" supervisor, Bob Little, built the miniature city for the opening title sequence of *Mr. Bug Goes to Town* (Paramount, 1941).

Photographer unknown



RIGHT: Puppeteer and model maker Bob Jones with the miniature of Stromboli's wagon; film of the 3-dimensional model was used to generate "wash off relief" cels that could then be hand-painted for a smoother integration with the character animation than would have been possible had the "flat" characters been registered, frame by frame, to a solid filmed object.

Sequence 4 *Pinocchio* (1940)

Directed by Hamilton Luske and Ben Sharpsteen



Disney himself was not averse to the idea of modelmaking per se: numerous miniature buildings, props, vehicles, and sets were produced by his in-house team over the years, but these models were intended for reference only, not for inclusion in the films themselves. Like the sculpted maquettes that were created to assist the character animators in maintaining the volume, scale, and perspective of the figures they were drawing, Disney wanted his artists to be informed by these miniatures. What he *didn't* want was for the audience to be distracted by them.

From Stromboli's wagon in *Pinocchio* (1940) all the way through to Cruella De Vil's car in *One Hundred and One Dalmatians* (1961), 3-dimensional props were built by the studio, not only as reference for the artists but also to get around the

time-consuming challenge of hand-rendering complex mechanical objects in true perspective. However, the chosen footage showing these props in motion always went through a final process of translation into two dimensions, whether by hand-tracing or xerography, before any attempt was made at integration with the painted cels of the animated characters.

"WORLDS CREATED IN DEPTH ON SHEETS OF PAPER"

For many years, Roy Naisbitt was in charge of layout at Richard Williams's studio in London. Throughout our interviews Roy spoke passionately about every aspect of the work that he'd been involved in over the course of a long career in film and animation but, before anything else could be discussed, it was a matter of urgency to him to

communicate one fundamental point. Roy believes that "2D" is a misnomer.

Over the years Roy has heard the term "2D" from a great many younger artists working in different areas of computer animation and, by the time we met, the all-too-convenient shorthand of "2D" as a blanket term to describe traditional, pencil-drawn animation had begun to grate on him because, as he was keen to emphasize, it betrays a failure to grasp even the basics of either observation itself or the act of drawing:

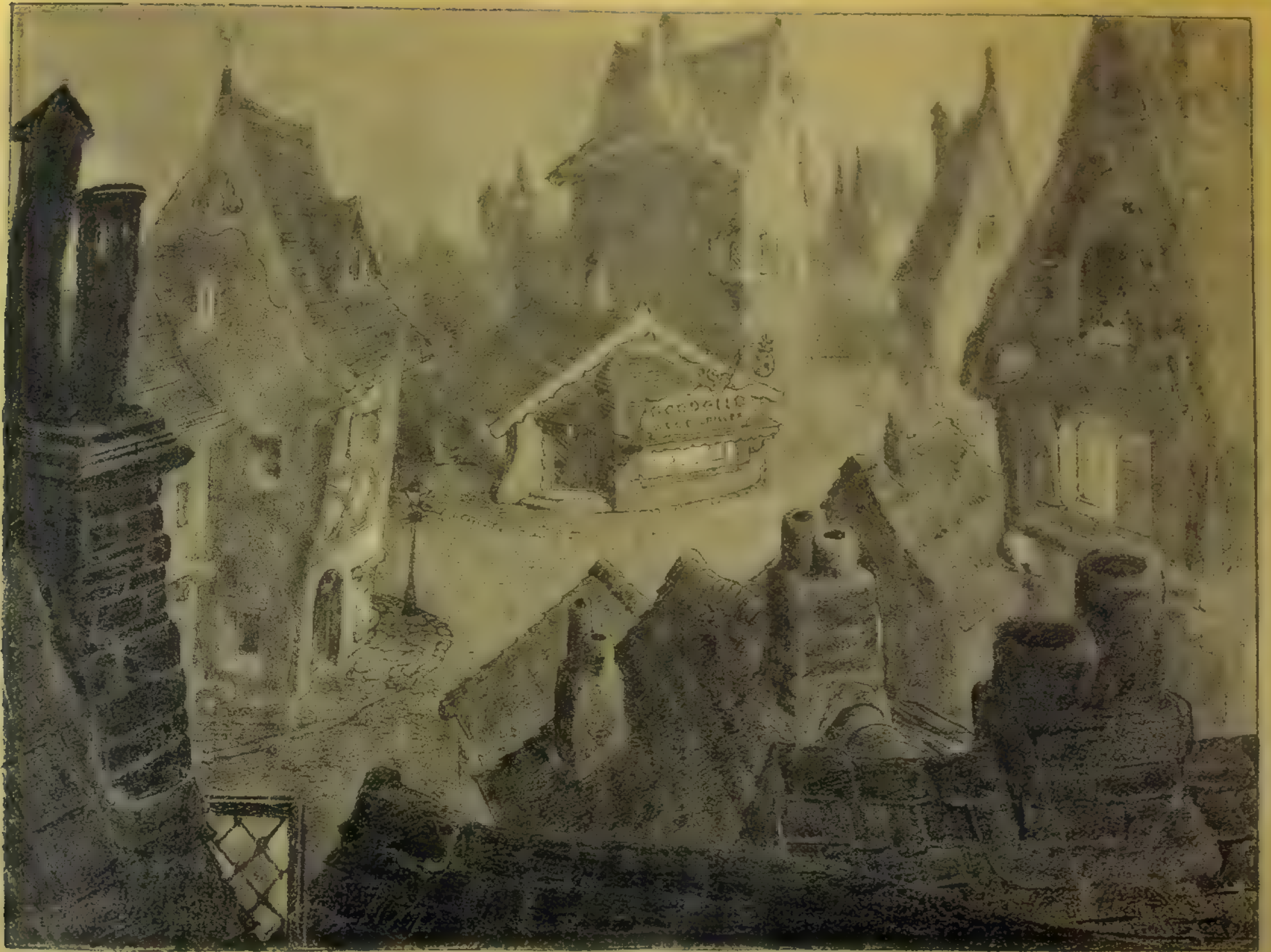
Traditional animation is now known as "2D," which suggests to me that everything you draw stays the same size and only moves in the plane of the paper. The beauty of drawing on paper is that you create a real 3D world on a flat surface. This is

Preliminary study for the opening scene of sequence 2 in *Pinocchio* showing the light in Geppetto's window at dawn, many hours before the ringing of the school bell; "concept" artwork like this can help suggest all manner of possibilities to the film-makers with regard to the timing (and illumination) of the action.

Drawing by Disney Studio Artist

Pinocchio (1940)

Directed by Hamilton Luske and Ben Sharpsteen



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LEFT: Poster for *Pinocchio* (1940), continuing the studio's practice of promoting the new "Multiplane Technicolor" technique.

Pinocchio (1940)

Directed by Hamilton Luske and Ben Sharpsteen



RIGHT: Poster for *Snow White* (1937) emphasizing the importance of the studio's new "Multiplane Technicolor" technique.

Snow White and the Seven Dwarfs (1937)

Directed by David Hand



something that I don't understand. Why call traditional animation "2D"? It's 3D! We draw in 3D. If you look at *Snow White*, *Pinocchio*, and *Dumbo*, these were worlds created in *depth* on sheets of paper. This is the one thing that, to me, was absolute magic; every day I worked I thought, "God, we're creating a world on a piece of paper!"

If it took time for his effects artists to animate realistic-looking contact shadows, and if it took even more time for the camera operators to run detailed tests for the animators weeks before performing the multiple exposures of the various different elements required to get those shadows onto film, then so be it. No jarring mismatch between an idea itself and the materials used to realize it could be permitted to jolt the audience out of their suspension of disbelief. The Dwarfs' cottage was going to be no mere log cabin, and this time it would be Snow White herself climbing the stairs with a lantern, not some oversized chicken in a hat.

When Disney made the move into feature-length movies he meant business. *Real* business, not the comedy "business" of a Mickey Mouse short or a *Silly Symphony*. And if his medium was flat artwork, then *all* of the artwork for *Snow White and the Seven Dwarfs* was going to be flat. Solid objects simply didn't figure in the equation.

Parallax, on the other hand, did.

The farther we are from a fixed object in space, the less it will appear to move as we ourselves move in relation to it. Whether we are walking slowly or traveling in a fast-moving train, the moon in the night sky will appear to move with us, while the trees by the side of the road or lining the railroad track will move so quickly that they register as little more than a blur. This phenomenon is known as *parallax*. Max and Dave Fleischer deliberately chose to point their "Stereoptical" camera

TOP A “Tilt Field” layout drawing in which the angle of photography is set at a diagonal, creating the illusion of a vertical camera move in the final shot even though the pegged BG artwork is moved horizontally beneath the lens.

© Disney Animation

Illustration by Robert M. Cook, from *The Art of Disney Animation*

MIDDLE The nocturnal landscape image used by Disney in a 1950s *Tricks of Our Trade* documentary to demonstrate the creation of a realistic parallax effect on the studio’s multiplane camera.

BOTTOM Still from an animated diagram featured in the same 1950s *Tricks of Our Trade* documentary.



at miniatures on a revolving tabletop because a wheel has similar properties, inasmuch as the movement of the perimeter edge is greater than the movement at the center.

By holding fast to the proven notion that flat artwork held parallel to the film plane produced a more convincing and less distracting pictorial illusion of environmental depth, the Disney multiplane design turned its back on any idea of “real” light playing across physical objects positioned behind or in front of the flat cel-painted characters. As Roy Naisbitt so rightly says, “We *draw* in 3D.” If models were going to be built at Disney, they would be built for the artists to refer to while they were drawing or painting. The Dwarfs’ cottage, the Old Mill building, Stromboli’s wagon, and the birdcage in which he imprisons Pinocchio are all examples of detailed models that were constructed and filmed in motion for reference, but Disney understood how immediately a bad join could break the pictorial illusion for the audience, and he knew better than to try to force objects to coexist with moving drawings. If hand-drawn animation is what your artists produce, then you build a model to make their drawings and paintings look better, not to emphasize how flat they are by comparison.

Unlike the earlier experiments in multilevel animation photography, Disney’s multiplane

allowed drawings to be drawings. The character cels and the background artwork were all permitted to lie flat beneath the camera, and it was the responsibility of the artists themselves to think and draw in “depth” in order to create the required illusions of light playing across objects in a room or features on a landscape. If a character picked up a lantern or moved closer to the fire in a darkened room, the special effects artists, also thinking and drawing in 3D, would design an appropriate play of shadows and animate them frame by frame over both the character and the environment, thereby enhancing the illusion of depth and solidity.

From this point on more than ever before, Disney’s scenic artists were going to be thinking in three dimensions and drawing with light.

A PLURALITY OF DRAWINGS: THE DEFINITIVE ANIMATION MULTIPLANE CAMERA

The number of drawings required to engineer and construct the enormous “Control Device for Animation,” as the Walt Disney Studio’s multiplane was coyly described in U.S. Patent 2,198,006, would have been more than enough to fill every one of the machine’s own precision-g geared “transparent carriers” many times over. The side elevation diagram, which takes up the first page of the application document, shows no fewer than five

The side elevation and circuit diagrams from the patent application (filed in 1938, granted in 1940) for the multiplane animation camera designed by William E. Garity for the Walt Disney Studios.

independently illuminated parallel shelves and is accompanied by another 33 equally detailed technical illustrations, including a wiring diagram so complex it looks like the transportation map for some futuristic city:

Generally stated, the method contemplates adjustably positioning drawings and other pictorial representations in spaced relation, the drawings and representations occupying parallel planes. Certain of the drawings may be made on transparent carriers while others, particularly the background drawings, may be made upon opaque carriers. An adjustably positionable camera then photographs the various drawings, opaque elements, or figures carried by some of the transparencies.

In this introductory paragraph alone the word “drawings” appears no fewer than five times, while no mention is made of anything 3-dimensional other than the giant apparatus itself. This imposing “super rostrum” was the result of determined labor and dazzling ingenuity on the part of two men in particular: William E. Garity and Roger Broggie, Sr. At first glance it looks almost as though the two men had managed to tip a large Victorian theater onto its rear wall before reducing it in size to a point where a 35mm movie camera could perch comfortably over the proscenium arch.

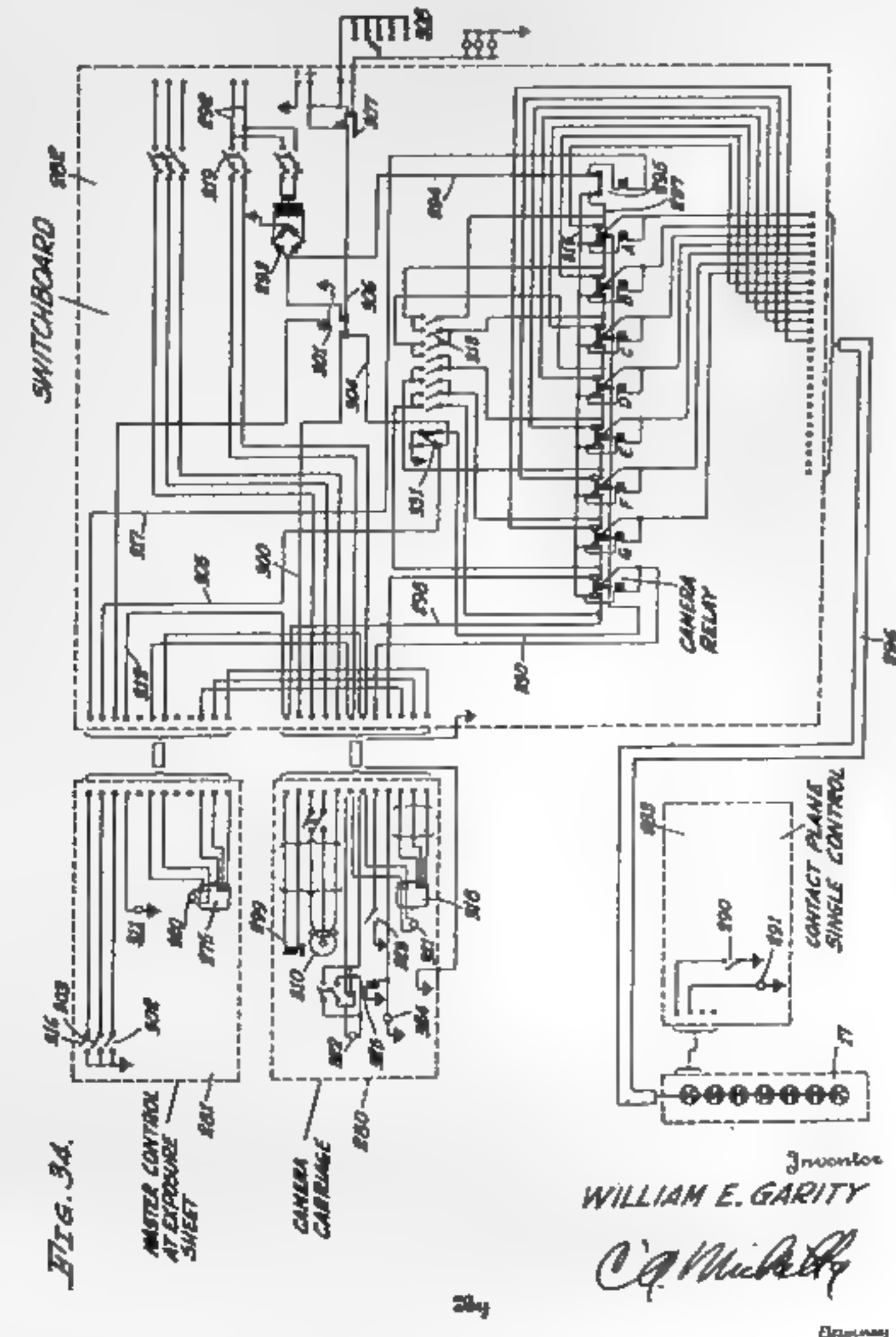
Even those camera operators who were already accustomed to photographing a single level of animation artwork patiently, one cel at a time, must have scratched their heads and wondered what was in store for them now. A quick read-through of Garity’s densely worded patent application would have done nothing to relax them:

When a plurality of separate drawings are being photographed in the manner described, a number of operators is required, each one being entrusted

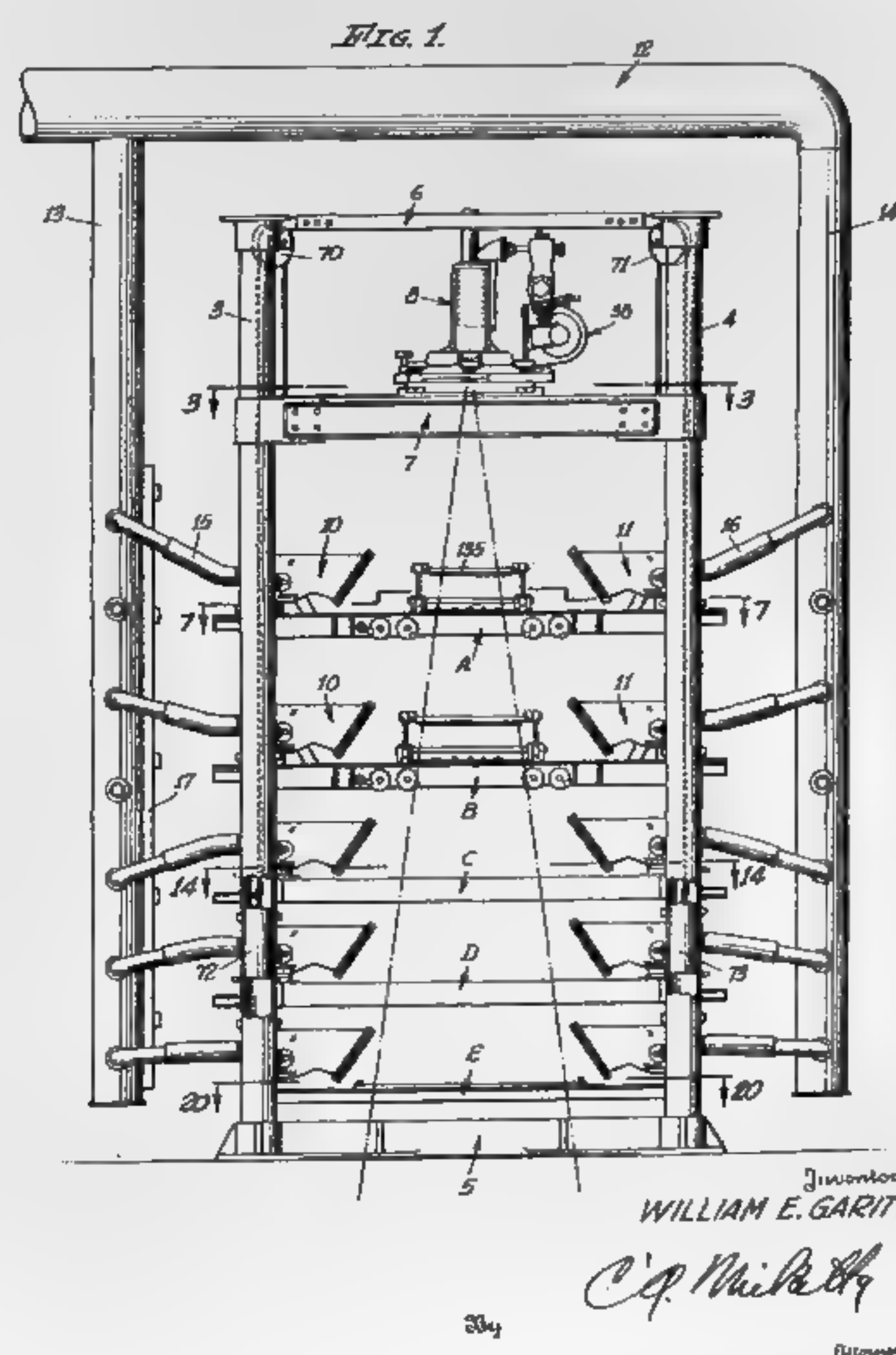
with the care of a single drawing or plane in which the drawings are adjustably positioned. In order to make certain that the camera is energized only after each operator has completed his particular adjustment, the invention provides means whereby the camera may be operated from a remote control, the control being effective only when a master circuit is locked in position by the combined acts of the various operators.

Don Iwerks explained to me how this ingenious system worked in practice:

April 23, 1940. W. E. GARITY 2,198,006
CONTROL DEVICE FOR ANIMATION
Filed Nov. 16, 1938 10 Sheets-Sheet 10



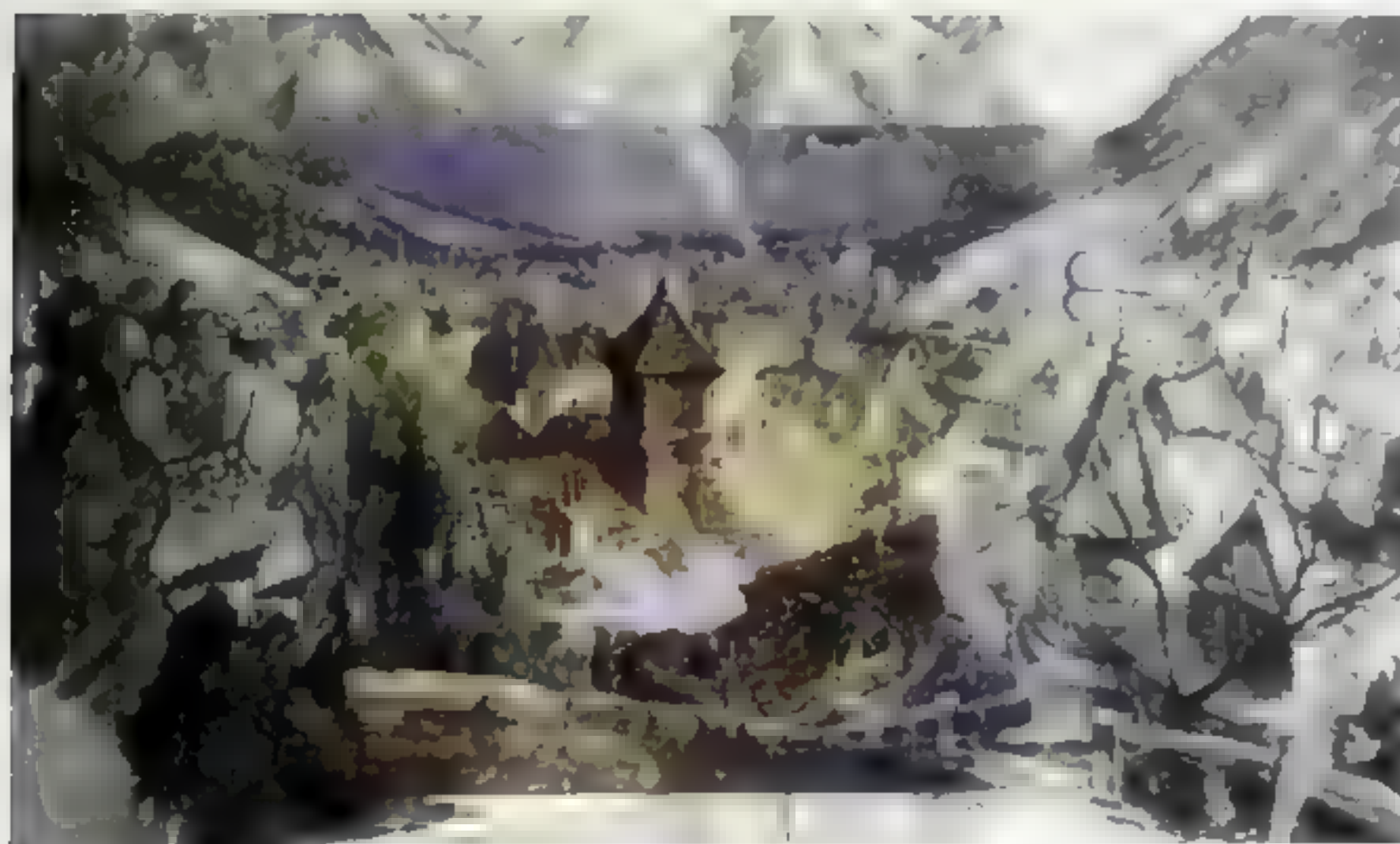
April 23, 1940. W. E. GARITY 2,198,006
CONTROL DEVICE FOR ANIMATION
Filed Nov. 16, 1938 10 Sheets-Sheet 1



On every level [i.e., at the level of each of the glass shelves], the guy would make his moves according to the exposure sheet for his level and when he had that done he’d flip the switch, but there was an electrical feature on the stand that meant each switch was in line with the shoot button so that if any one of them hadn’t been tripped yet, the camera operator couldn’t shoot. So as each guy on each level did his work, they hit the switches and then that opened up the main switch for the operator to shoot a frame.

After each exposure the lights would dim automatically while the guys changed everything on

Pencil artwork and frame enlargements showing parts of the final color background paintings for Levels 1, 2, 3, and 4 of the 6-level multiplane shot seen at the opening of sequence 2 in Disney's *Pinocchio* (1940)



each level, ready for the next frame, and then the light would come back up again. And they always shot with the lamps a little under voltage. I remember my dad saying that they always ran the lamps at about 90 volts so they would get extended life, instead of burning them at full voltage.

None of Don's description makes you want to climb back through time to 1938 and apply for a job as a camera operator at the studio. As Alvy Ray Smith, one of the architects of Disney's CAPS system and a founding employee of Pixar, told me:

There was some special effects textbook that had a photo of the original Disney multiplane stand being manned by lots of men, and there was even a rumor that it could only be used at night because it took down the Burbank power grid.

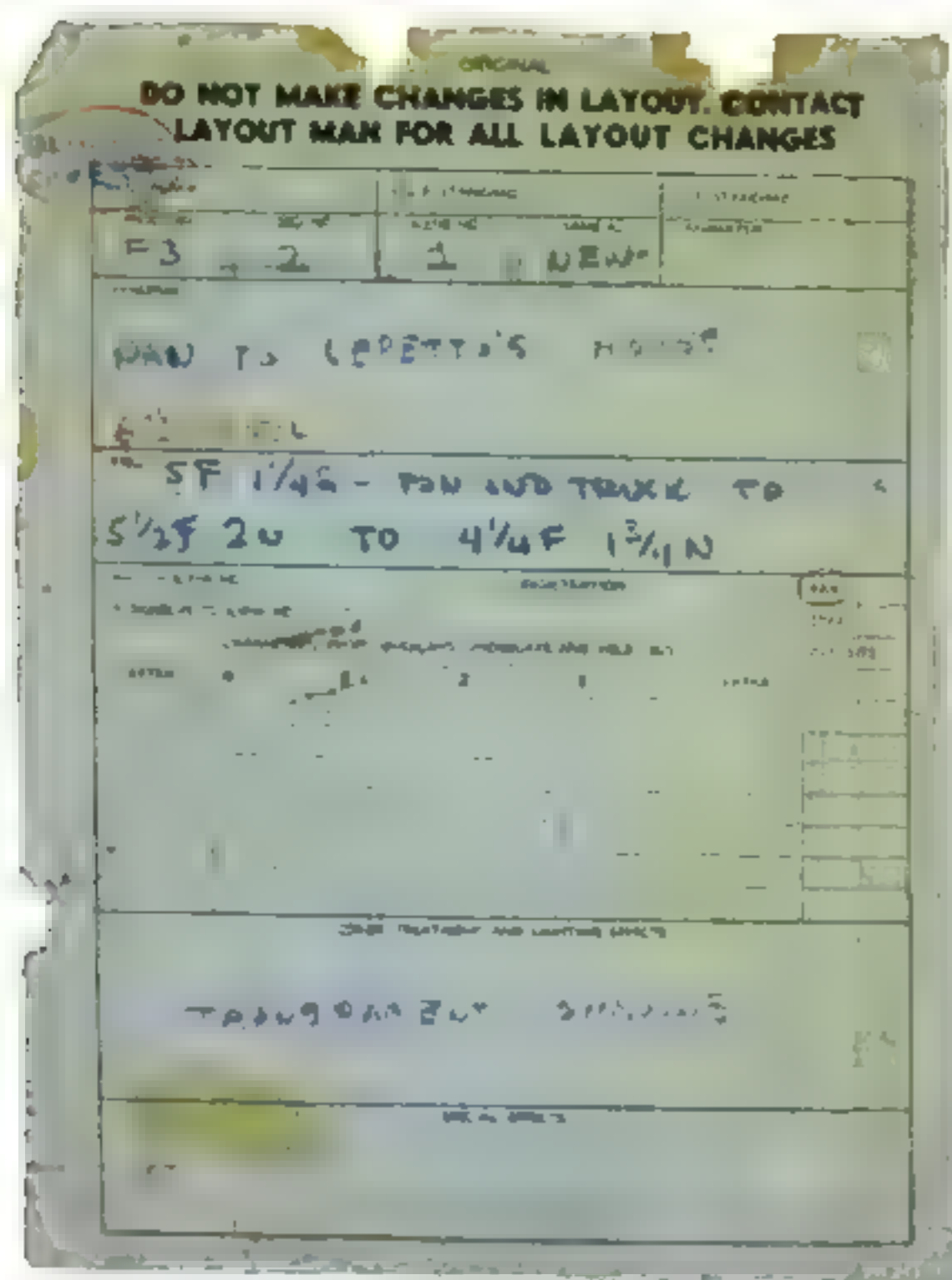
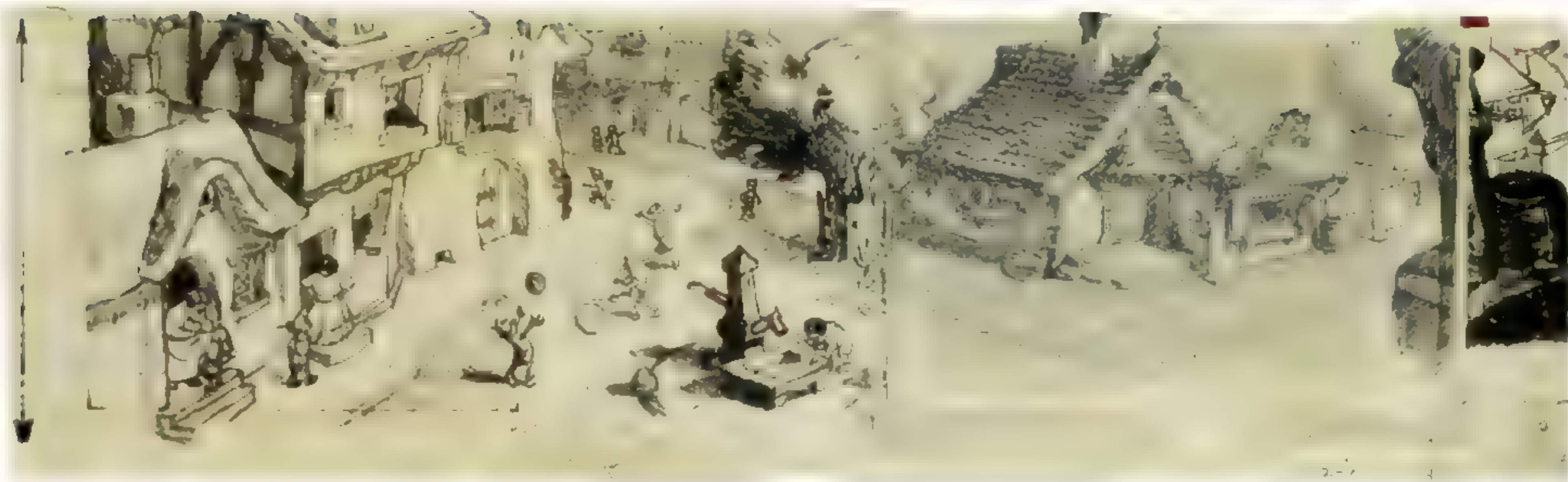
GOING TO WORK IN THE DARK

Whether or not the rumor was true, sharing the air between shelves with enough lamps to create stifling heat and yet having to accept that they were wired in such a way as to deprive you of enough light to read by couldn't have been easy. Though Tom Baker first worked at Disney in 1987, when the work of the multiplane stands was finally being taken over by the computer, he knew only too well what it was like to multitask in the kind of conditions Don Iwerks had described:

When the disposable penlights came out, that was it! You just kept one in your mouth all the time you were shooting a scene and you would bite down to trigger the switch when you wanted to see your notes and you'd undo it when you didn't. Before we had the penlights you'd have a small lamp over the easel where you wrote all your notes and you'd tape over that lamp to knock down the light with black tape so no light escaped.

TOP The only surviving pencil layout artwork (showing Level 6, combining rough artwork of the village square with a cleaned up drawing of the exterior of Geppetto's workshop) from Sequence 2, Scene 1 of Disney's *Pinocchio* (1940). Directed by Hamilton Luske and Ben Sharpsteen

BOTTOM Cover sheet for level 6, rough artwork. Sequence 2, Scene 1 of Disney's *Pinocchio* (1940). Directed by Hamilton Luske and Ben Sharpsteen



Artists, of course, can't possibly work without proper illumination, but unwanted light could be just as dangerous a commodity in a rostrum space as it was in any darkroom. On one research trip, Tom kindly came over to the ARL to help tackle some of the technical detective work concerning one particular Disney multiplane scene which, according to many critics and historians, has really never been bettered: Sequence 2, Scene 1 from *Pinocchio*.

In a fade-up from black, accompanied by a bright orchestral score, we see the bells chiming in the tower of a little school in the Italian Alps. Prompted by the noise of children shouting in the village below, the camera begins to move down across the tiled rooftops, doves wheeling in front of it as it traces the line of a footpath leading down through the trees and houses. Mothers shoo children from doorways, schoolbooks are left to one side as somebody's head gets dipped in the stone basin at the water pump.

Finally we arrive at the doorway of Geppetto's workshop, where the shadows of the children passing on their way to school play over the figure of Pinocchio as he jumps eagerly from one side to another of the top step. The stone steps themselves are even cut in a circle to add to the sense of the children's shadows "wheeling" along, beginning to draw Pinocchio in to this exciting new world. Had these same levels of character and scenic artwork been pressed together in a single-plane sandwich beneath a platen glass and photographed on a regular rostrum camera table, every component would have remained at the same distance from the lens. The design of Garity and Broggie's multiplane stand, with its generous separation between the different glass shelves, allowed the animation camera to find (and then lose) focus on the various individual planes of action and scenery as it moved forward into this "living illustration," drawing the audience with it.

The original exposure sheet (marked "DEADLINE 8/28/39") for the test shoot of the original pencil layout and rough animation components of Sequence 2, Scene 1 of Disney's *Pinocchio*, peppered with the pinholes made by the multiplane camera operators to indicate their progress from one frame to the next, moving and photographing each level of rough artwork.

Pinocchio (1940)

Directed by Hamilton Luske and Ben Sharpsteen

It's easy to see why revered live-action director Sergei Eisenstein, among others, marveled at the technical and artistic brilliance of these multiplane shots. With the original drawings now in front of me in the Disney ARL, my own attention was taken by the quality of the draftsmanship. Meanwhile Tom's eye went to the edges of the paper. "You know, what's really interesting is that none of this artwork is pegged . . ."

He was right. Though some of the items laid out on the table in front of us had tiny incremental marks penciled along the edge, none were peg-registered. And there were other things to wonder at on the exposure sheets, as Tom pointed out:

I'll bet you anything a camera operator or an animator wrote these notes, because normally all you get is some dialogue notes in the left-hand column. You'd never normally get clear, detailed action notes like this.

In live-action, the camera operator is there when the actors perform. If we look through the viewfinder during rehearsals, it's possible to see at a glance how each scene will be framed. By contrast, every movement and every object that has to be captured by a regular or multiplane animation rostrum camera is created elsewhere, one piece at a time. Thousands of separate cel elements may need to be brought to the table and photographed one at a time over (or between) individual levels of background and foreground scenic artwork, so the first thing the operator has to do is check the inventory to see what has to be photographed and study the written instructions on the exposure sheet to see how everything has to be moved relative to the lens over the course of the scene.

I have worked mainly with digitized artwork myself since the early 1990s, so the sheer complexity of traditional animation camera work came

home to me as Tom read through the *Pinocchio* multiplane sheets:

You know what's really interesting too? Look how they're doing their pan. Every increment is $\frac{1}{64}$ of an inch, so their pan bar must have been broken down into 64 numbers for one revolution; on all the cameras I worked on 100 numbers always equaled one inch. And something tells me they didn't have counters yet on these cameras, and they were breaking everything down into inches and just using rulers. And that would have been the smallest breakdown they could do, so when you see " $\frac{1}{64}$ " on the X-sheet, they were probably still using some sort of tape measure or ruler to get their distances.

With the arrival of the first Disney multiplane camera, a whole new world of guesswork and experimentation had opened up in terms of planning, designing, and testing the individual level movements that would deliver the kind of believable perspective shots this specialist rig had been designed to create. Such challenges would seem, during the late 1930s in particular, to have inspired rather than deterred the technical and artistic crew that Disney had assembled.

THE UNIVERSAL MULTIPLANE

Although everything in the surviving paperwork for the two rough-test scenes supported the notion that they had been filmed on the giant vertical multiplane stand, the Camera Department and layout artists at the Walt Disney Studio, far from being left in peace to work out the technical intricacies and operational challenges of this new piece of equipment, had instead been presented with yet another challenge as *Pinocchio* moved into production. As film historian and writer J. B. Kaufman was kind enough to point out to me some weeks later:



LEFT The foreword to the Fleischer Studios production manual states that "To produce cartoons efficiently, it is important to know how to obtain the best results with the least amount of work" and encourages all employees to "Read the book carefully and keep it on your desk at all times for handy reference."

Foreword page from the Fleischer Studios' in-house production manual (late 1930s)

FOREWORD

The purpose of this book is to familiarize animators and their assistants with the technical requirements necessary to the production of Animated Cartoons.

To produce cartoons efficiently, it is important to know how to obtain the best results with the least amount of work.

Established short cuts, if used to advantage, make for high efficiency and enhance the artists value to himself and to the company. Animation on TCC--closer use of repeats--elimination of unnecessary tracebacks by use of the three cel levels--handling crowds by impression rather than drawing each character--the use of an overla, blocking off a large part of the crowd--these are but a few of the practices which make for efficiency.

It is important that artists thoroughly acquaint themselves with these methods and plan their scenes with the standards established herein. Read the book carefully and keep it on your desk at all times for a handy reference. For your convenience, it is indexed so that solutions for everyday problems may be found with a minimum of delay.

RIGHT Pages from the Fleischer Studios production manual (late 1930s) explaining the kinds of animated scenes that can be photographed on the company's unique "Setback" animation camera.

Pages from the Fleischer Studios' in-house production manual

1935 COPY

Large Field Set-Back Camera
(When a Wide Shot)

The abbreviated term for this camera is "Wide-Set".

The purpose of this camera is to give a third dimensional effect in the background. The glass on which the scene is shot is mounted vertically in front of a large cylindrical drum as usual miniature set is mounted. This set is built in perspective and turns on a pivot point so that the farther an object is from the lens, the slower it moves, thus creating an illusion of depth in the background.

This camera should only be used to film and for scenes that will show up this effect to best advantage.

Fields Allowed This camera is a set field camera and can not be swung in any direction. It is the equal of the two set-back fields. (Check with stencil plate standard field for exact size of field.)

Background Drawing Allowed You can use horizontal, vertical or diagonal pans on the set-back camera. You can go from a horizontal to a vertical to a diagonal or any combination of the above.

Limitations You cannot shoot an approach, a reveal, or any approach field, or still for sliding pans in this camera.

Background Layout A layout to be used for this camera is shown up the camp as it would be for the ordinary pan, but efforts should be made to have an arrangement to allow for objects in the background to move each other in painting.

Pan Shots Plan your pan across the set as you would for the ordinary pan.

Animation Action must be planned so that there is no direct switching or switching in the set-back set.

The material for this book has been compiled by Jack Spitzer and Raymond Lusk.

If clarification of any section of the contents is necessary, the above should be consulted for a verbal explanation.

Overlays If an overlay is arranged to extend below the bottom Cutting Field, it acts as a cut-out, thereby saving a cel.

If the overlay is within the Cutting Field, it acts as a sliding cel.

Cel Levels Three cel levels are allowed. The general rule for jumping cel levels applied here too. Cut-outs or repeats on sliding cels cannot be used, but one sliding cel may be used to pan a cut-out in, out, or thru a scene.

It is a good principle in animating for the set-back camera to keep the cel levels down as low as possible, that is, if it does not necessitate unnecessary frame-backs. Best results are obtained with a **two cel level**.

How to Arrange for a Set-Back Before you definitely plan your scene for a set-back shot you must consult Johnny Bode.

Large Field Set-Back Camera
(When a Wide Shot)

The abbreviated term for this camera is "Wide-Set".

Fields Allowed This camera is a set field camera and cannot be swung in any direction. It is the larger of the two set-back fields. (Check with stencil plate for exact size of field.)

Background Drawing Allowed Only horizontal pans can be shot on this camera.

The same instructions that hold for the Standard Field Set-Back Camera hold for the Large Field Set-Back Camera with the above exceptions.

Be sure to see Johnny Bode before definitely planning a set-back scene for this camera.

Though not a permanent fixture in the Disney Camera Department, the "Universal Multiplane," captured in these remarkable photographs from the Schultheis Notebook, allowed certain uniquely ambitious multi-level scenes in both *Pinocchio* and *Fantasia* to be photographed using a horizontally oriented camera running on rails.

Photographs and handwritten notes from the notebook kept by Herman Schultheis, a member of the Camera Effects Department at the Disney Studios in the late 1930s and early '40s.



SIDE VIEW SHOWING LEVELS

LONG TRUCK THRU VILLAGE
SHOT ON LARGE CAMERA CRANE
THIS IS A FIVE LEVEL SHOT
THE CAMERA TRUCKS IN
FROM A DISTANT SHOT,
PASSES BUILDINGS,
TREES, THE MAIN SQUARE
OF THE VILLAGE, ENTERS
AN ARCHWAY AND FOLLOWS
A STREET TO GEPETTO'S HOUSE



CAMERA SET UP FOR LONG SHOT

The finished version of Sequence 2, Scene 1 was actually filmed on a horizontal track. Some of the camera technicians referred to this horizontal setup as "the large multiplane" or "the universal multiplane," though I don't think they were trying to confuse later generations of historians: I think they equated the two setups because they both used the same principle of widely separated background levels, therefore either one produced a multiplane scene.

Thankfully one or two photographs of this temporary horizontal rig do survive and can be found in the Herman Schultheis notebook, recently restored by the Walt Disney Family Museum.

Frustrated by the size restrictions imposed by the confined spaces between the glass shelves of the vertical multiplane and perhaps inspired by the logic of the earlier Fleischer and Iwerks systems, the Disney camera effects crew decided that

there would be practical benefits to filming larger individual pieces of scenic artwork on a temporary horizontal rig, with the camera running on rails similar to the tracks that would commonly be laid for a live-action dolly. Working against gravity, the vertical peg-registered platen glasses on this rig would have required powered mechanisms to hold them shut over each of the subsequent animation cels. As Tom Baker rather succinctly put it, "That must have been torture for the operator."

With the development, first of the vertical and then of the horizontal Disney multiplane, scenic design for cinema animation had come full circle, arriving back at something that bore a striking resemblance to a regular theatrical proscenium. What separated Disney's approach from both full-scale and puppet-theater design was the absence of anything other than flat artwork. Neither the "performers" nor any component part of the interiors and landscapes they inhabited was solid.

Instead it was the job of the artists to imbue every one of these flat objects with volume, form, weight, and solidity.

Likewise, it was the job of the layout artists and the camera operators to design and execute entirely linear camera movements in which the only possible rotation was about the central axis of the lens itself. And yet, for all their simplicity, the timing and trajectory of these same camera movements had to combine with inventive and convincing illustrative layout work in order to conjure a wholly believable and fully rounded world from images rendered in two dimensions. How much easier it would be to photograph something real.

Endnote

1. The term "Setback" camera comes from The Fleischer Studios' in-house handbook compiled in the late 1930s.

4

**“HOW DO
YOU MAKE
A MOVIE?”**

"It's not just drawing pictures, it's 'How do you make a movie?'"

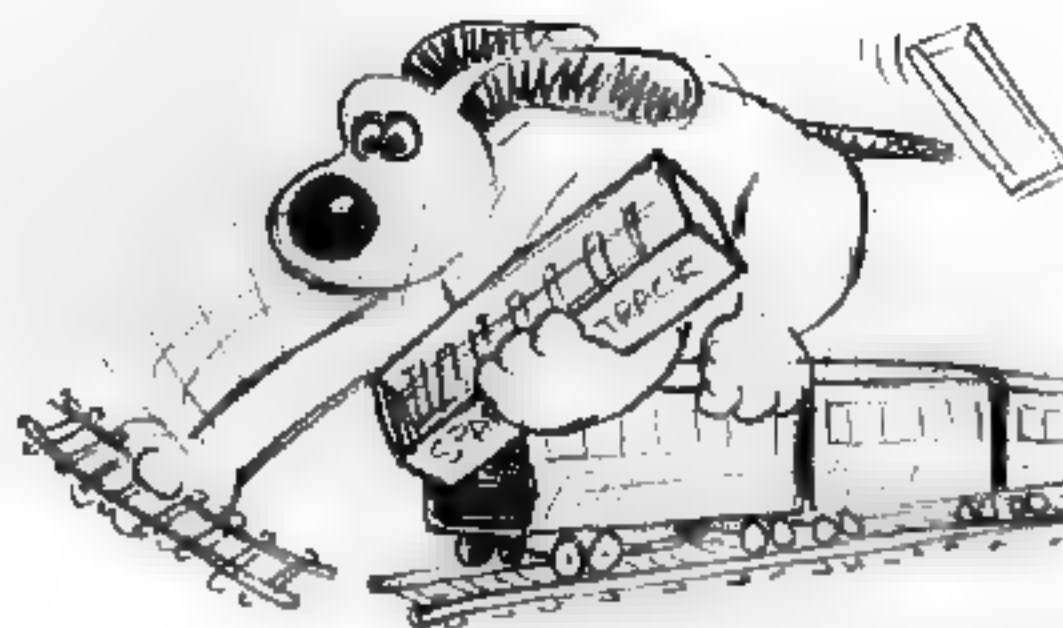
BILL PERKINS, LAYOUT ARTIST AND ART DIRECTOR,
WALT DISNEY ANIMATION STUDIOS

If a character in a live-action movie climbs out of a window on the second floor of an apartment building, runs down the fire escape, and then crosses a busy street to jump in a getaway car, by careful positioning of a single camera mounted on a tripod, all the action could be captured from a first floor window in the building opposite. It's a sequence we can all run in our heads easily enough and it wouldn't be too tough to storyboard either.

If the same scene is to be animated traditionally, however, the challenge for the layout artist is how, using only flat artwork, to turn the storyboard into a working production template for all the different departments to follow. Even rough animation can't begin until the animators know the geometry of the ground planes and background outlines the character has to register to, and even slight changes to the suggested framing will affect how much of the character the audience will see at any given moment and therefore how much of the figure actually needs to be drawn and at what scale.

All movies happen a rectangle at a time (so to speak), and when you're making an animated movie the sheets of paper on which the character is drawn could, in some instances, be used to represent the full frame of the action—but you can't cut to a new shot every time your animation reaches the edge of the screen. The camera might be required to capture a facial expression at the start of a scene, for example, with the

character's head being drawn within a tiny area of the full sheet of paper (or corresponding cel), but if the camera then pulls back to the limits of the rectangle, showing the whole character as he or she starts walking from left to right, what happens when the character reaches the edge of the available paper? There's a great visual gag in Nick Park's film *The Wrong Trousers*, where Gromit, trapped on a runaway toy train, notices that the rails only go so far. To avoid disaster he grabs a box of extra track and hurriedly lays one length after another on the carpet directly in front of the speeding carriage. If we think of each rectangle of animation paper as one of those lengths of spare track, this is pretty much what traditional layout artists have to do: not only do they create the "carpet" of the scenic artwork, they have to consider the full scope of dramatic movement in each scene and then "lay track" across the scenery for the characters to animate across as they follow the required directions.



But there's another problem: the rectangles of animation paper have to be positioned in a straight line following the metal registration strip (peg bar) that corresponds to the registration holes punched along one edge of every sheet. If the character is animating from left to right, the peg bar will be used to secure either the top or the bottom edge of the paper, according to the animator's preference. When one rectangle is no longer enough for the required sideways movement to be drawn in full, a longer metal registration strip (panning peg bar) with additional registration pegs is used so that at the transition point either two sheets of rectangular paper—or one wider, continuous sheet—can be used to get the character across the join.

It's important to remember that animators and inbetweeners can't work comfortably on extended sheets of paper because they need to flip several pages at once as they build up the movement of the character, so the sooner the layout artist can get them back to the comfort and convenience of animating on single, smaller sheets the better. Increase the time it takes to produce a single drawing and you slow down the whole production pipeline.

SIDE PEGS

Let's return to our own scene example for a moment—the man racing down the fire escape of the apartment building. If the opening panels of the storyboard call for a close-up on the bag of stolen money he's carrying, followed by a short sideways movement of the camera as he crosses the fire escape (which then becomes a downward tilt that lets us see him make it to the foot of the metal ladder before he runs off), what is the resulting mosaic of paper rectangles going to look like? We know we could get the character from left to right across the landing of the fire escape by "laying track" sideways to give him room, but what do

PREVIOUS, LEFT. Seen in its entirety, this background layout displays a twisted "impossible" perspective; viewed "in motion," a section at a time behind the continuous animated performance of the main character (as intended), the multilevel cityscape makes perfect visual sense.

Oliver & Company (1988)

Directed by George Scribner

Art direction by Dan Hansen

Layout by (among others) Rasoul Azadani & Bill Perkins

we do if the storyboard tells us that his first big move within the scene has to be vertical?

Because the character has climbed out of a second-floor window and is heading for the street below, we will have to lay the first section of our paper "track" vertically to allow room for his progress down the fire escape. This will mean limiting the character's initial sideways action to fit within the shorter dimension of the side-pegged paper. Then, when he reaches street level, we're going to have to lay track at right angles to this first vertical section but, because animation paper only has registration holes punched along one of the longer sides, we're going to need a second panning peg bar, this time running horizontally, so that the sheets of paper can continue far enough to allow the character to be drawn and photographed reaching the getaway car.

In situations like these, a traditional layout artist has to work with the lead character animator to determine the optimum point in the action where the animators can stop working on side pegs and begin to animate on top or bottom pegs. Tom Baker described to me the "hand over" process that such complex scenes would involve when the scene arrived in the camera department:

As camera operators we always used the term "jump pegs" when we were using any temporary pegging that was not internal to the camera bed. On scenes that required "jump pegs" you would have a verbal handoff from the animator or art director to describe their intent because the handwritten notes on the exposure sheet could only define so much of the camera mechanics. The animator would say, "OK, start here on these pegs and then the animation will move down the paper to the bottom. From there I'll jump to these other peg holes and start the animation at the top of the paper again to hook up smoothly."

PREVIOUS, RIGHT Storyboard panel, scene 63

The Wrong Trousers (1993)

Directed by Nick Park



PLAYING TO A FIXED CAMERA

If the chosen camera viewpoint in our imaginary scene is in a first-floor window of the building opposite, that means we'll be looking up at our character at the beginning of the scene and looking down on him as he crosses the street below us to get into the car. Real actors, of course, have real sets to run across, but for the animated version of a scene like this the layout artists will need to create a wide, hand-drawn architectural blueprint showing the full panoramic sweep of the buildings, the alleyway, and the main street, all rendered in believable perspective.

On a live-action set the camera would be mounted on the fluid head of a tripod and the operator would be performing a series of partial rotations of the camera body, some horizontal, some vertical, and others diagonal, to follow the action as the actor traveled through real physical space. But because the film plane must remain parallel to the flat artwork at all times, the only rotation a traditional animation camera can make is around the lens center, so to duplicate the effect of a live-action camera swiveling to point up, down, and across, the layout artist must include

LEFT: A wealth of architectural detail fills this background painting of an empty city street while the careful control of the tonal values leaves large areas "open" so that the character can read clearly as it moves through the scene.

RIGHT: Frame enlargement showing BG painting of Popeye's father's bedroom, complete with boat-shaped swinging bed.

Problem Pappy (1941)

Directed by Dave Fleischer



a series of perspective cheats in the flat drawing so that the major structural lines of the environment recede to more than one vanishing point.

As a result, the completed background painting, viewed all at once, will have a rubberized appearance but, thankfully, because the camera will only be capturing small areas of it at a time, none of this will be apparent in the final film. The animators will also need clear checkerboard grids to work with so they can create believable volume and weight in the character's performance, and these need to be included along with the blueprint.

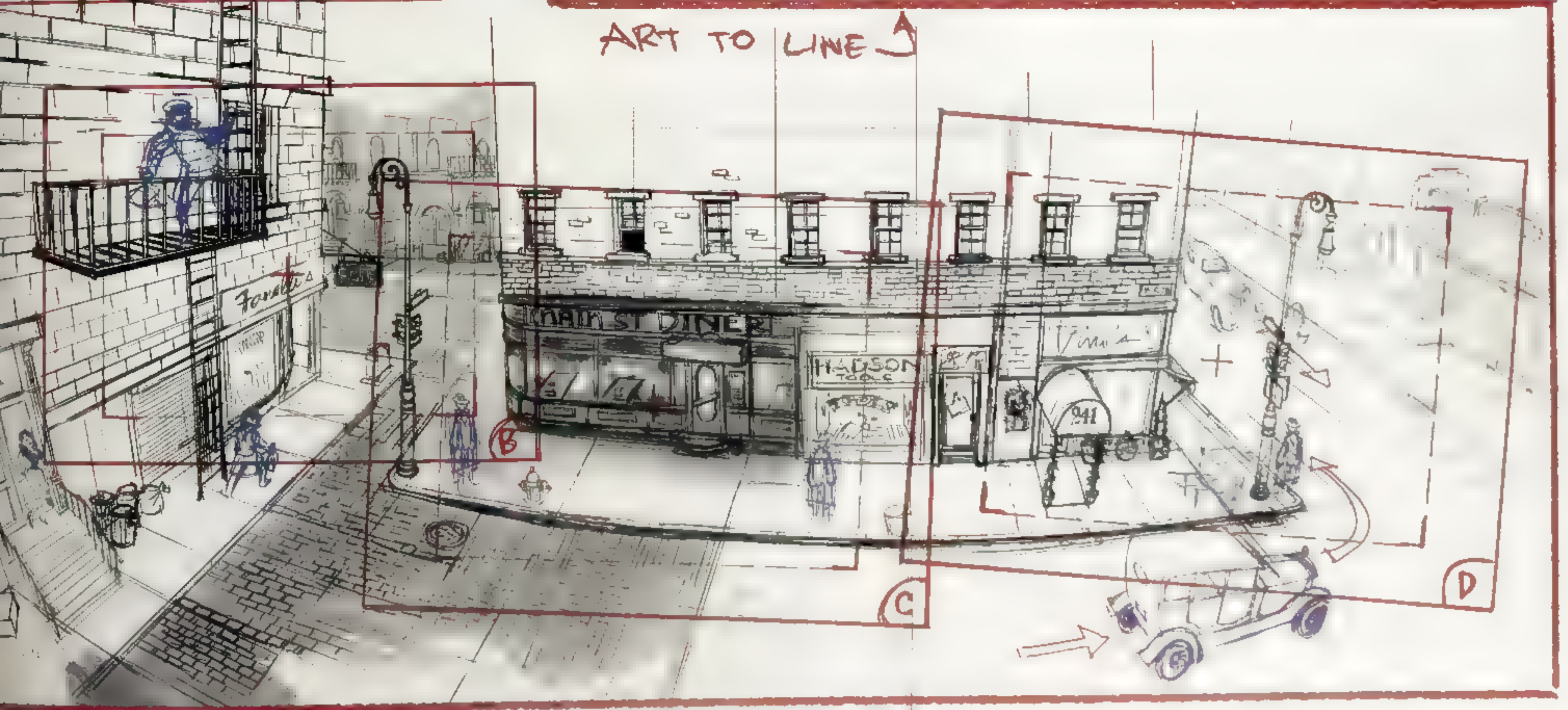
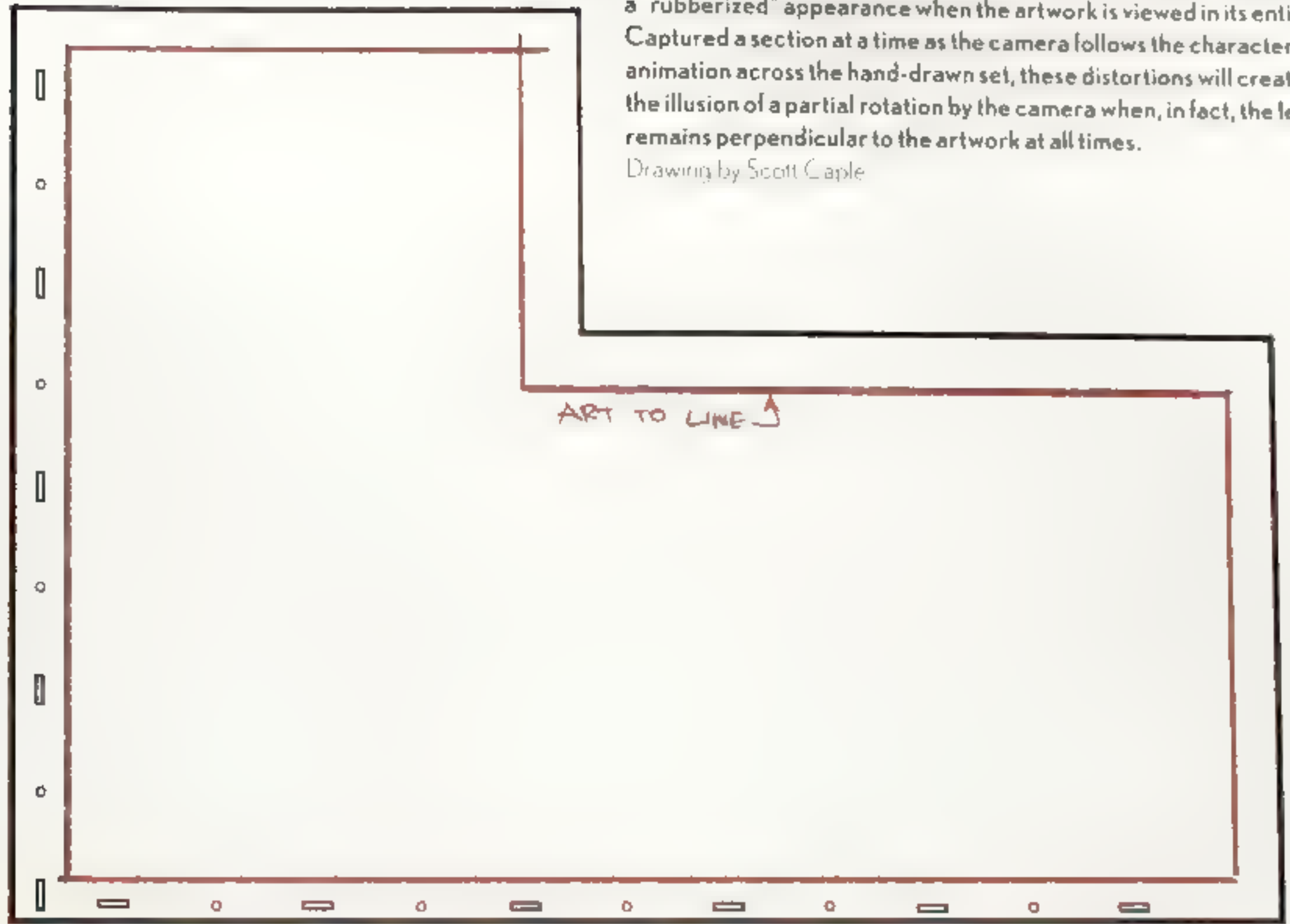
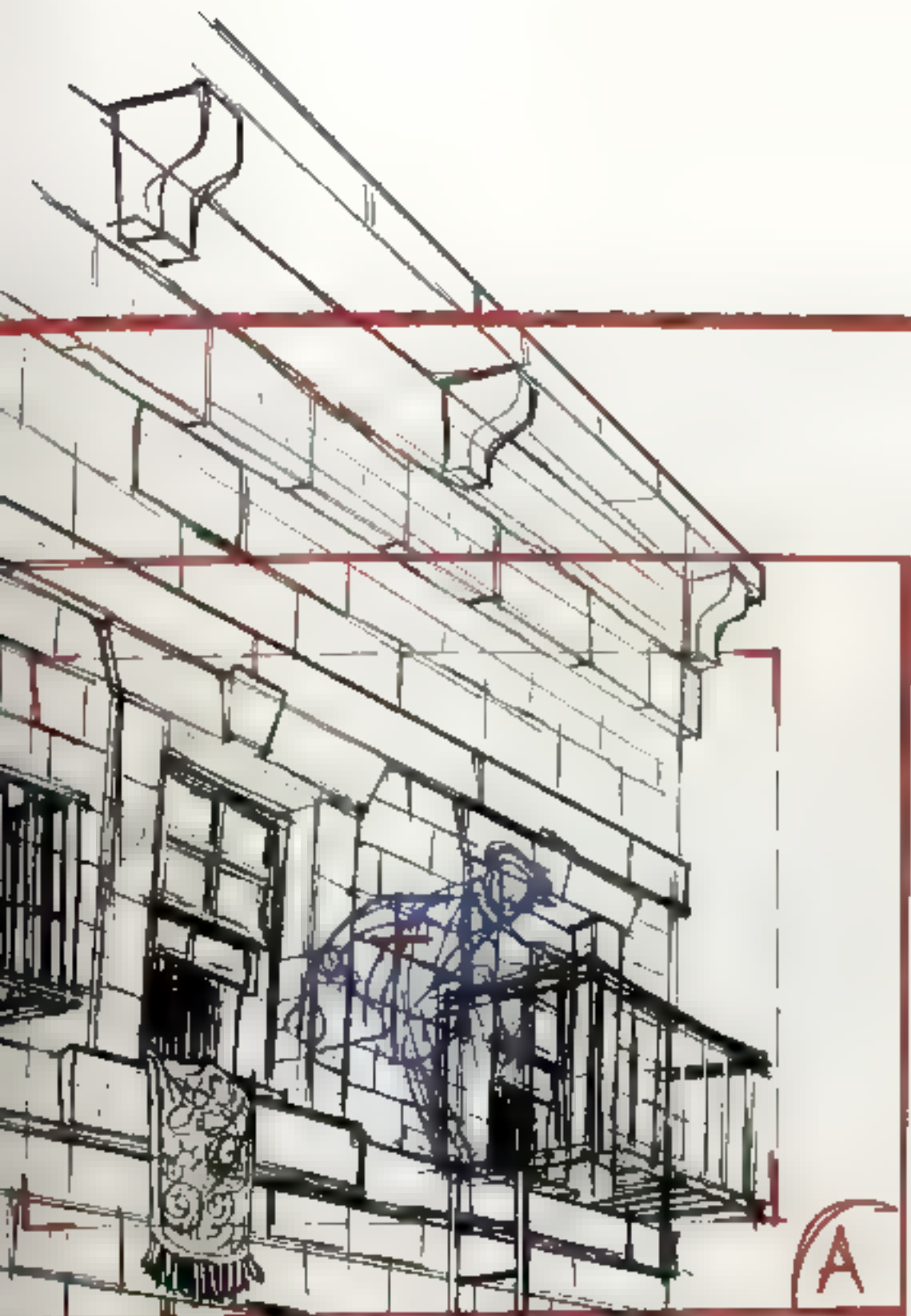
L-SHAPED ARTWORK

An animated movie may indeed start life as a bunch of line drawings on a series of rectangular sheets of peg-registered paper, but it's important to remember that the continuous background artwork which will be positioned behind the painted character cels on the rostrum bed is usually rigid and often has to be much larger than the character artwork, and therefore is more awkward both to handle and to photograph.

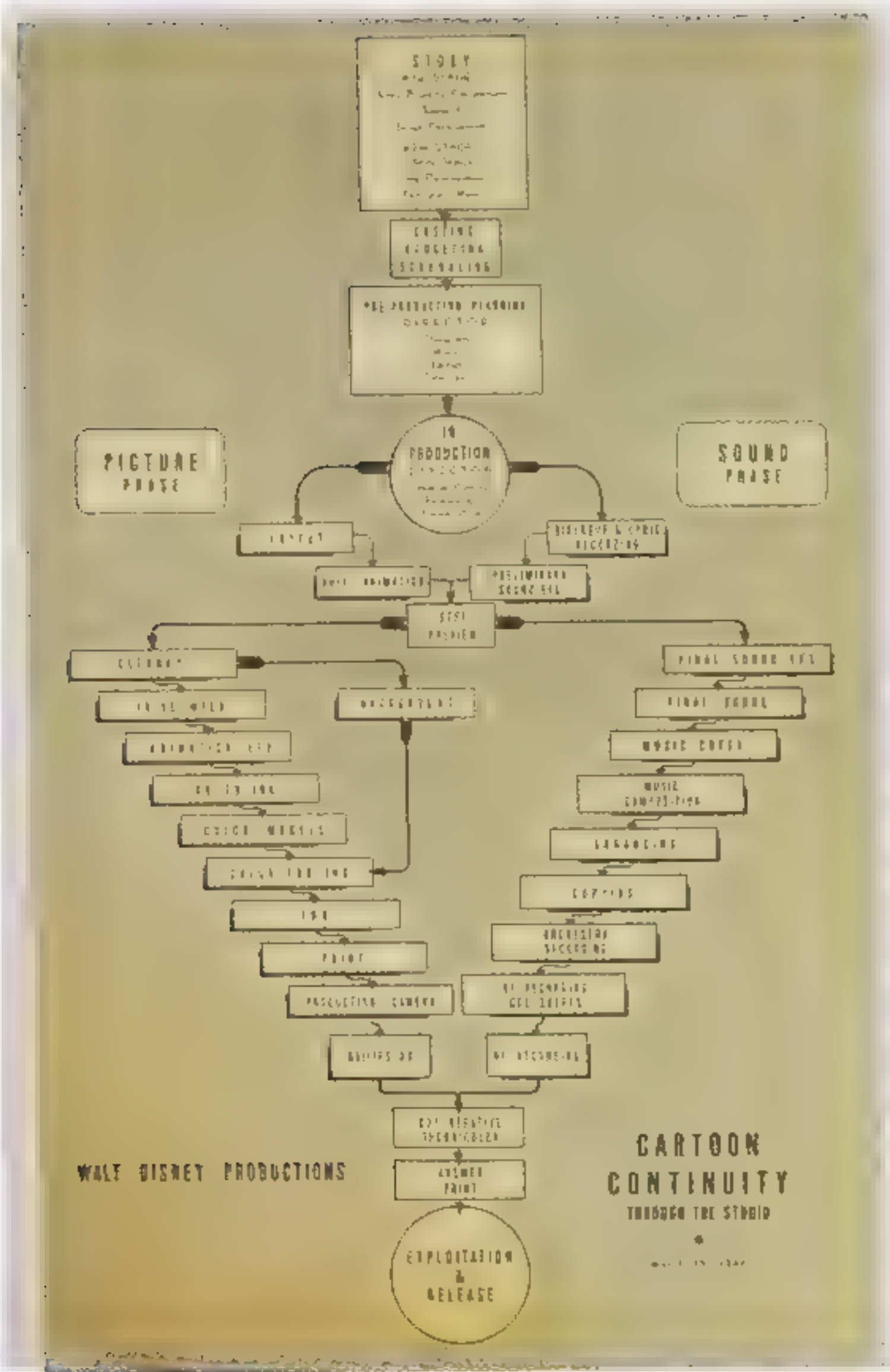
The layout artists have to anticipate the creative and the practical problems that may arise at each

For this imaginary scene, layout artist Scott Caple has created a series of perspective "cheats" which give the buildings and sidewalks a "rubberized" appearance when the artwork is viewed in its entirety. Captured a section at a time as the camera follows the character animation across the hand-drawn set, these distortions will create the illusion of a partial rotation by the camera when, in fact, the lens remains perpendicular to the artwork at all times.

Drawing by Scott Caple



TOP: Cartoon continuity chart produced by Walt Disney Productions' Management Committee (May 1946).



BOTTOM: Poster for *Gulliver's Travels* (1939). Directed by Dave Fleischer, produced by Max Fleischer. Fleischer Studios/Paramount Pictures

intoxicating process and can leave an inexperienced story artist with the feeling that all the really difficult stuff has been done. But beyond the warm creative glow of the story meeting lies the cold logistical reality of the production pipeline, and it is in this much less forgiving context that the layout team has to operate.

CREDIT WHERE CREDIT'S DUE: A DEPARTMENT EMERGES

The first time Layout appeared as a distinct departmental credit on a full-length Disney animated feature was with the release of *Cinderella* in 1950, although the job description itself had been appearing on internal paperwork at the Walt Disney Studios since the 1930s. It took nearly a dozen feature films, countless shorts, and the better part of fifteen years for layout to register as a creditworthy step in the studio's production process, distinct from either art direction or backgrounds. Acknowledgment of layout artists' skills elsewhere in the industry had also been a patchy affair; for a long time, some studios did not even recognize the term.

On their two features for Paramount, *Gulliver's Travels* (1939) and *Mr. Bug Goes to Town* (1941), the Fleischer Brothers listed their layout and background artists together under the heading of "Scenics." However, Leslie Cabarga, who interviewed many of the Fleischer background artists in the 1970s, believes that much of the character layout work at the studio was handled by the animators themselves:

I think the storyboards would include camera and staging information, and the head animator would then lay that out and from there it would go to the background painters. Obviously there would have been discussion, changes would have been made, and so forth, but until you started getting into the late '30s, a lot of it was very loose.

Animator, historian, and Fleischer scholar Ray Pointer emphasized some of the noteworthy design strengths of the Fleischer team:

The head of the Background Department at the Fleischer Studios was Eric Schenck. Artists like Bob Little and Anton Loeb worked under his supervision. There were many others who were working in the Background Department at Fleischer who came in from a theatrical-scenepainting background.

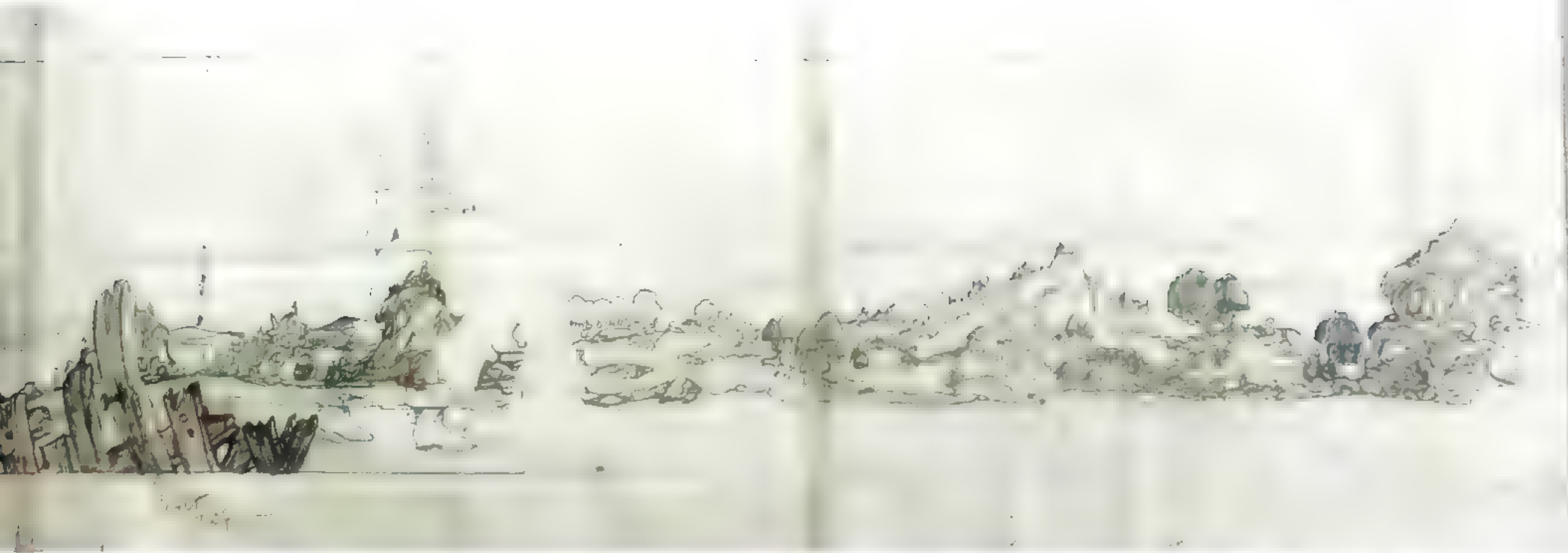
There are at least two signature aspects as far as design and layout that stand out most of all in the Fleischer films, more so up until about 1935: there's certainly an awareness of architectural structure that is very detailed and then there's the atmospheric aspect, the way that they rendered skies. That's very outstanding. In fact you don't see that in any of Disney's black-and-white cartoons. Disney's precolor cartoons are not really that detailed in their backgrounds. They used an awful lot of ink wash, a lot of it is very "airy," but the Fleischer backgrounds, by comparison, have a lot of tone to them.



successive step in the production pipeline and, with only so much room available beneath the camera itself, the question which most affects the desired continuity, particularly of any scene with a long, continuous camera move, may be, "What shape of final background artwork are we going to wind up with here?" Whatever artwork components the different departments are asked to produce, each item has to register precisely to all the others around it and the resulting parcel of elements, though flat, may stretch in a number of different directions. In spite of this, it has to be able to fit into the physical space of the rostrum camera stand where, one frame at a time, it will all have to be patiently and gently repositioned in order to be photographed.

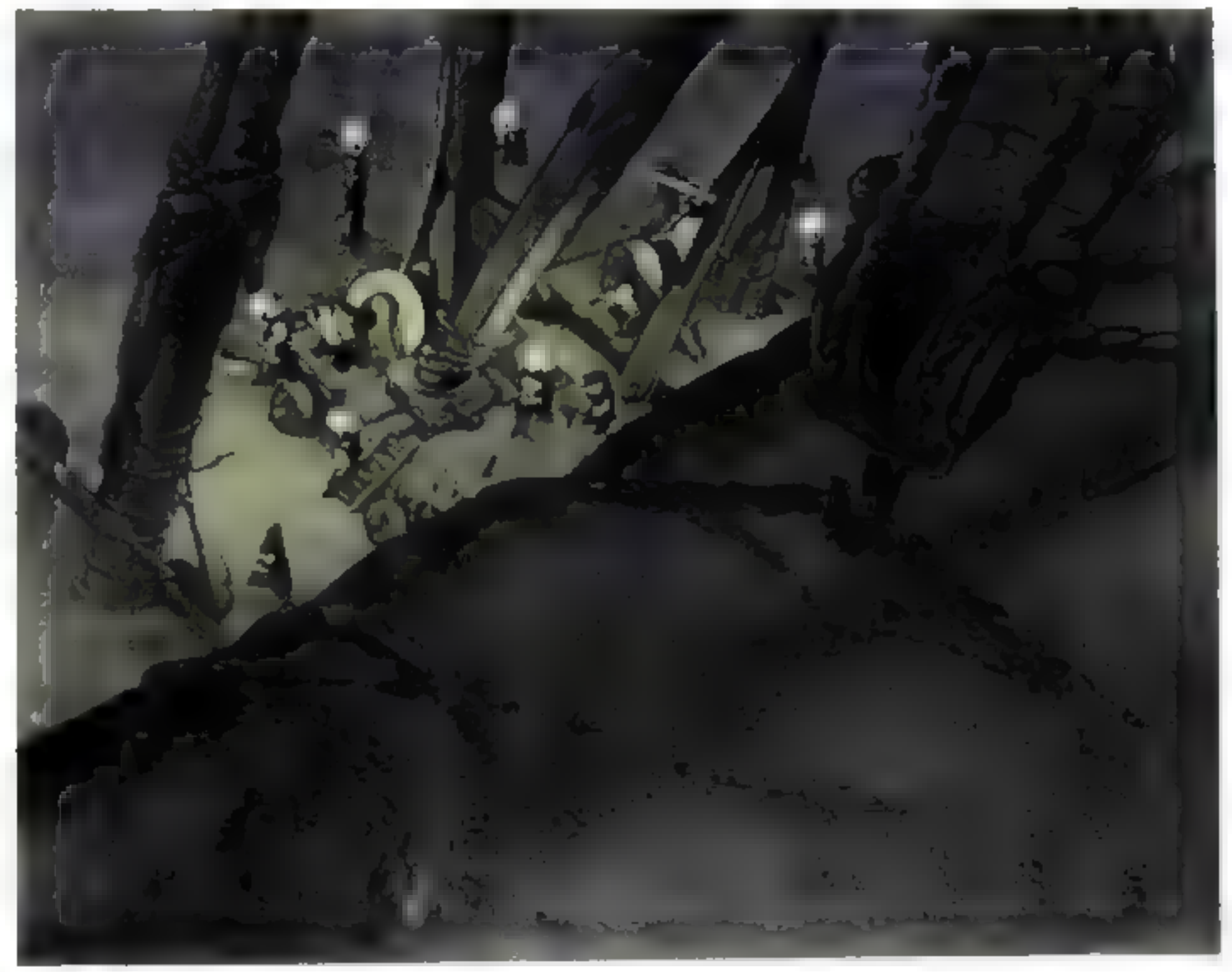
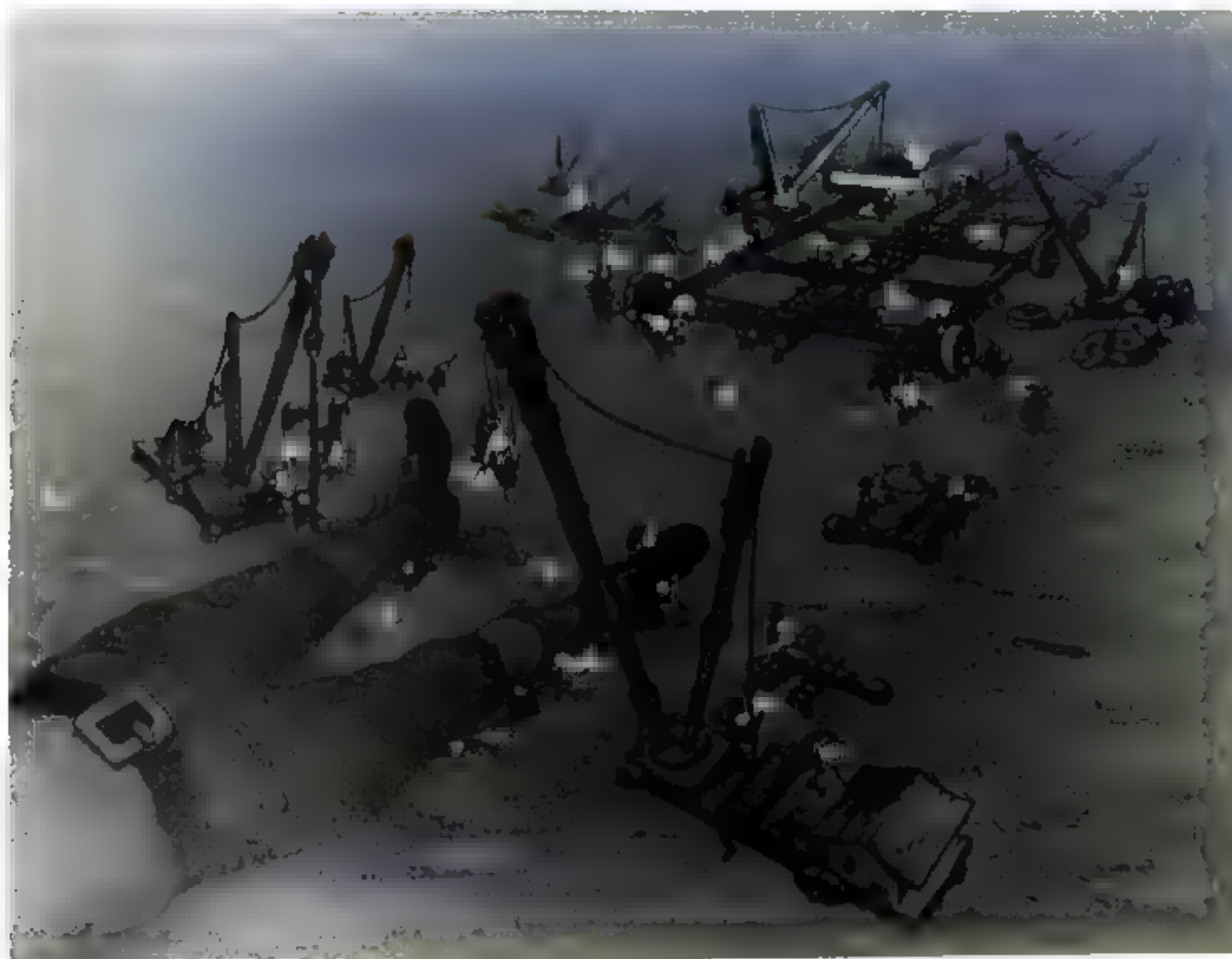
If we look again at our own suggested example, it's easy enough for a director to insist that all this action be captured in one continuous shot, and just as easy for a story artist to draw it that way, too; pinning up sketches and adding camera instructions in the margins can be a heady, almost

TOP Using the "rotoscope" technique originally patented by Max Fleischer in 1915, layout artists projected live-action reference footage of actor Sam Parker onto peg-registered paper and traced in blue pencil to create the imposing figure of Gulliver, visible in outline against the sky in this key layout design for a panning shot that will follow him as he walks through the painted townscape of Lilliput.



BOTTOM LEFT AND RIGHT 16-field production cels placed over original BG artwork signed for approval by background supervisor Robert Little, *Gulliver's Travels* (1939).

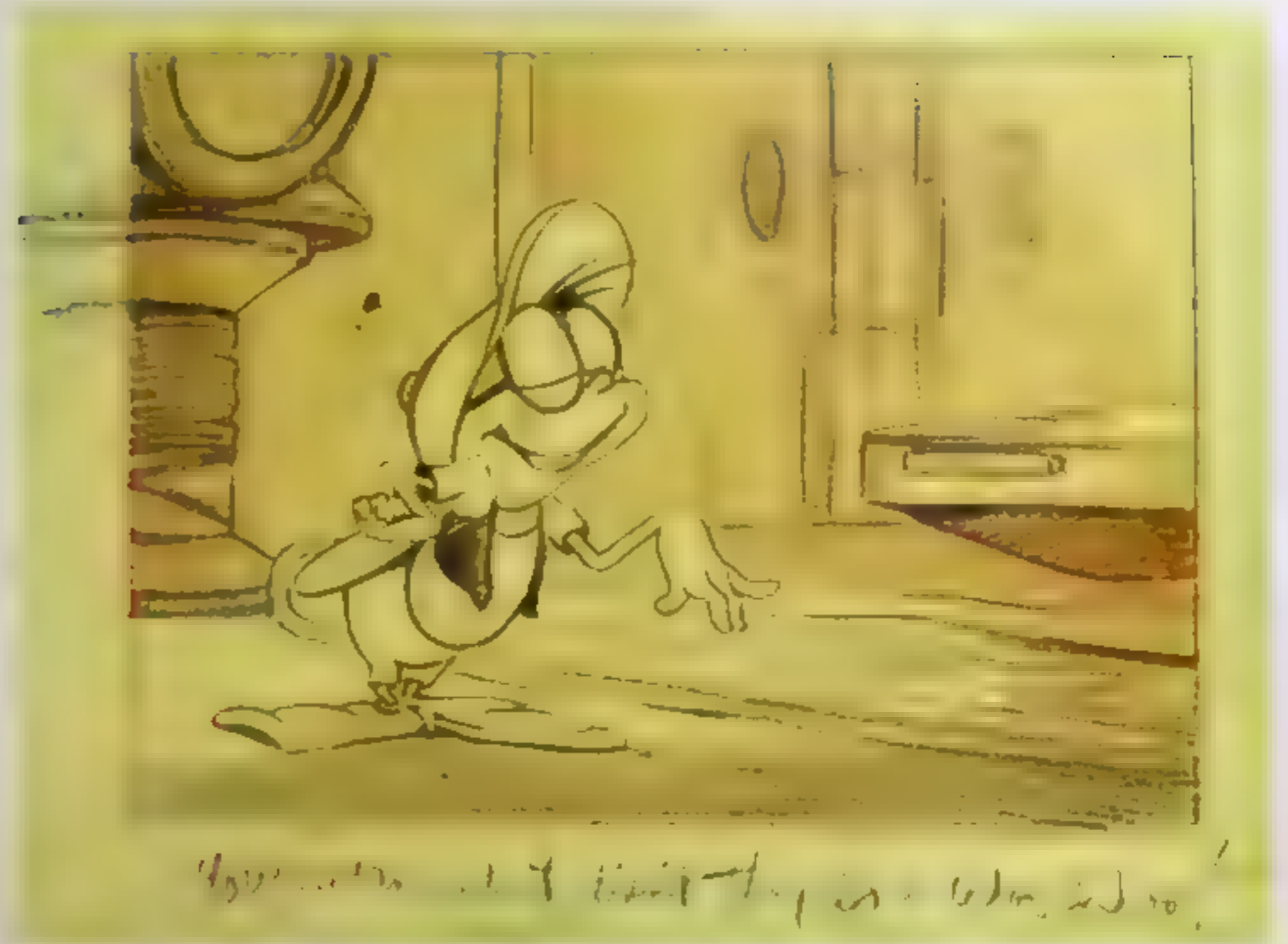
TOP RIGHT: COURTESY OF THE PRESIDENT JOHN F. KENNEDY LIBRARY; BOTTOM LEFT AND RIGHT: COURTESY OF THE PRESIDENT JOHN F. KENNEDY LIBRARY



Poster for *Mr. Bug Goes to Town*.

Gesture and lighting are both clearly indicated in this red pencil and graphite story poster.

In addition to the "red light" requested in the footnote or the graphite story sketch, a strong diagonal composition is used to "pull" the audience toward the live scene being watched by sidekick characters, Smack and Swat.



4/22/37 - Mr. Bug - 1st sketch - try in color, and so!



2nd sketch

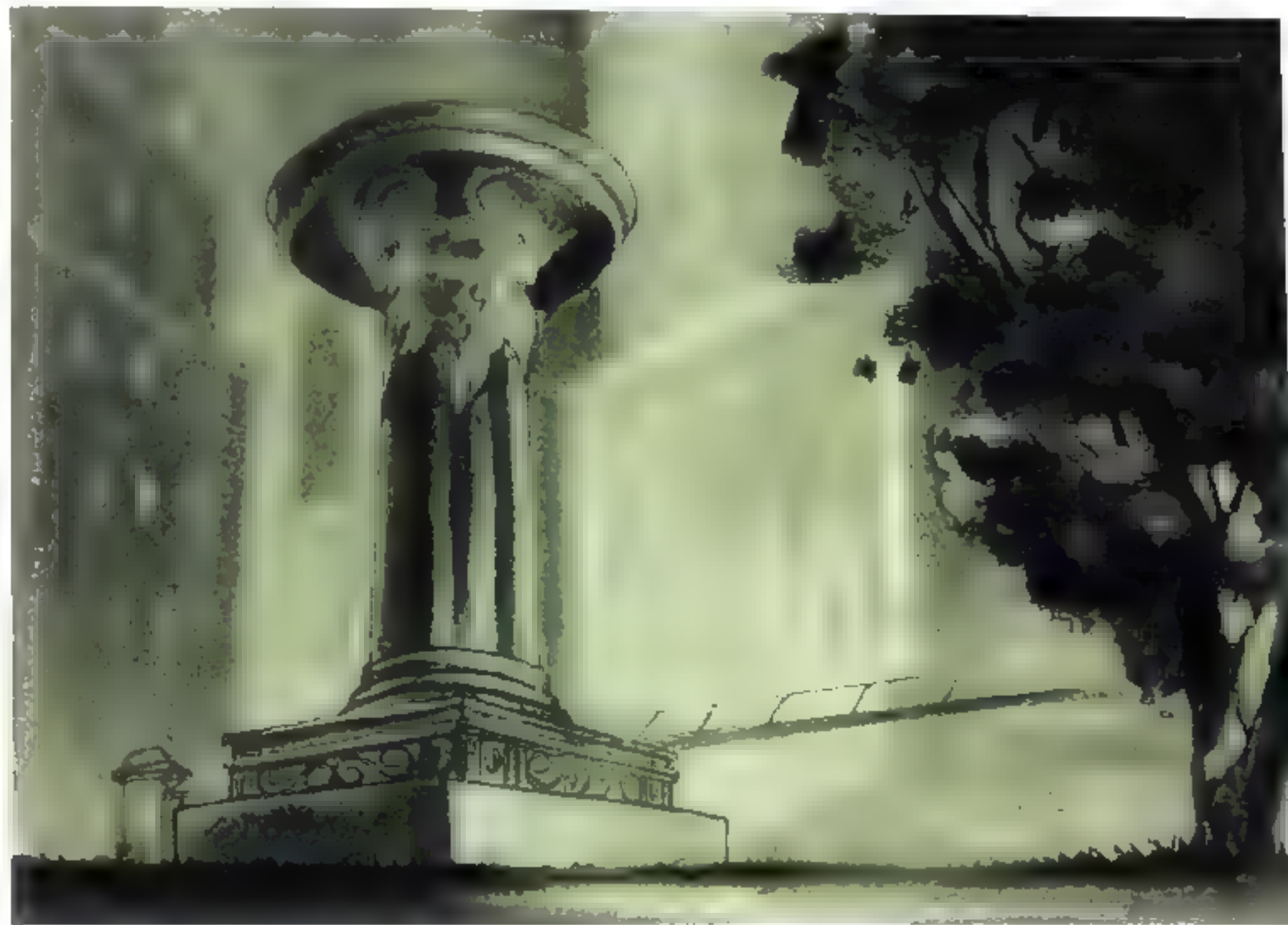
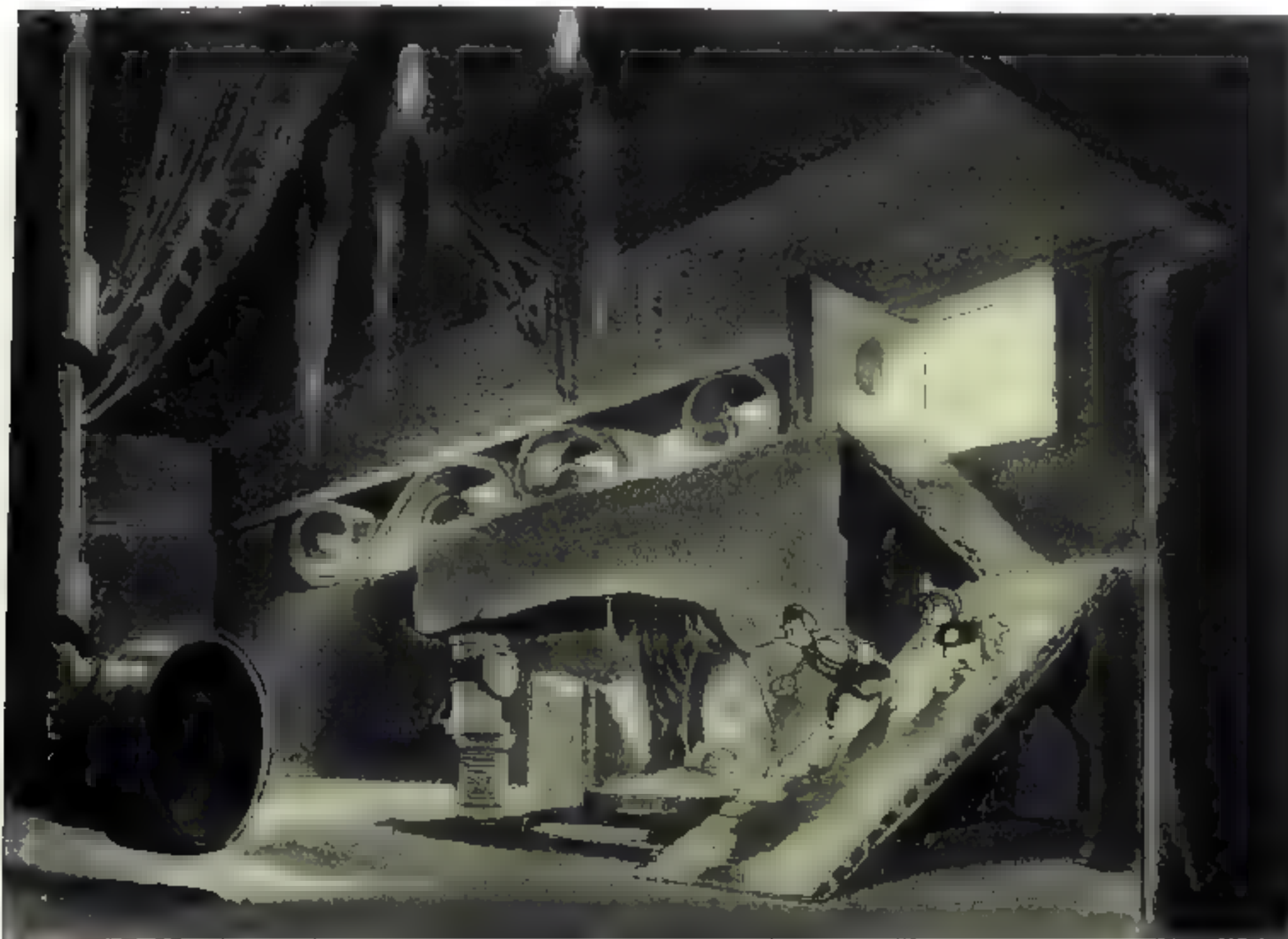
TOP LEFT Just as artists of the Renaissance learned to use "chiaroscuro" (image composition based on contrasting areas of light and dark) to "guide" the eye around a single painted image within a frame, so the layout designers and background painters of the 1930s and '40s developed a similar approach to "helping" both the camera and the audience's eye to follow the animated characters' paths of action within an environment.

TOP RIGHT Viewed from an insect's perspective, with the "lens" so close to the ground and the imposing city buildings as a backdrop, a simple birdbath assumes the grandeur of a skyscraper.

BOTTOM Even without a character cel positioned over the artwork it's possible to see from the framing of this painted doorway that the animated action will take place at ground level.

MIDDLE LEFT Original watercolor background artwork for *Mr. Bug Goes to Town* (1941), possibly painted by Shane Miller, signed for approval by Fleischer Studios background supervisor Robert Little.

MIDDLE RIGHT In this watercolor sketch, Hoppity inadvertently pours gasoline onto the burning hive



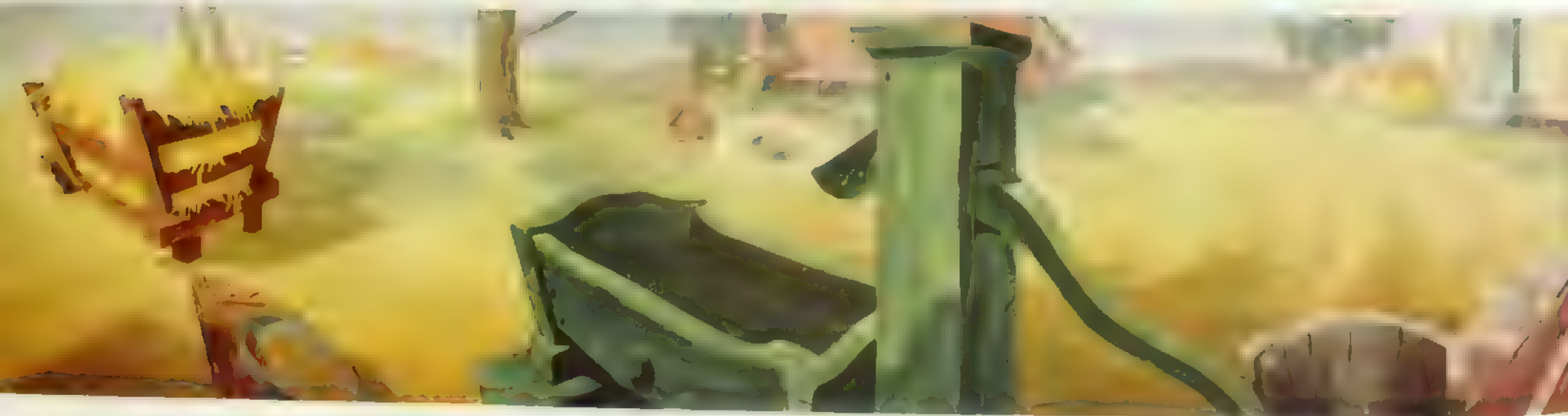




1001111 The cruciform pattern of starlight in the night sky emphasizes the Christmas theme in this watercolor development sketch of the Three Wise Men by Fletcher background artist Shane Miller. Bright highlights have been used to encourage the eye to move from the street surface in the foreground to the huddled buildings, climbing the high mountain peak beyond the rooftops via one or two key architectural details in the middle distance, much as the camera might be instructed to follow (or find) animated characters performing at different points within such a large exterior "location."

1001112 This aerial perspective demonstrates how much Hawley Pratt and Tom O'Loughlin shared with Drew Gentile and his father, Bob, in terms of spatial awareness, when creating broad establishing shots like these. "Traditional" layout and background artists have to bring a mapmaker's eye to their creation of the flat artwork.

1001113 A clear path of action has been created in this background painting, allowing the animator to fix the character's performance in the midground between the darker background subject and the less distinct features of the distant fields and houses.



LEFT: In the first of this popular and irreverent wartime training series, Private Snafu, "the goofiest soldier in the U.S. Army," tries to talk his way out of yet another disaster.

Frame enlargement from *Coming! SNAFU* (1943)

Warner Bros Studios

Directed by Chuck Jones

Produced by Leon Schlesinger



The late 1930s were, of course, darkened for everybody, first by the possibility and then by the reality of war. Although the strategic occupation of the Walt Disney Studio's lot by the American military had no clear parallel elsewhere in the Hollywood animation community, the studio was not alone in contributing to the war effort. Popeye had joined *The Mighty Navy* in 1941. Warner Bros. not only put Bugs Bunny and other existing characters into uniform for a variety of animated propaganda shorts aimed at boosting morale and selling war bonds, but the studio also came up with a specially designed character, the hapless Private Snafu, who starred in a series of inexpensive black-and-white military instruction cartoons.

Drew Gentle, son of background artist Bob Gentle, explained to me how his father's ability to translate 3-dimensional space into flat design had not only enhanced his background paintings for MGM, during the war itself it had even saved lives:

My dad was already thirty when he got drafted. They gave him an aptitude test and he achieved a perfect score on the spatial relationship stuff so they said, "You're a cartographer, you're going to make maps, and you're going to be in the tent with all the officers so you have to have a higher rank." So he became a Master Sergeant, which is like the rank of a thirty-year enlisted man, as though he were a tough-as-nails kind of career army guy.

So, here's my dad, a sweetheart of a guy, anything but the epitome of that, walking around with all these stripes on his arm. And he was thinking, "Oh! This is great! I got cushy duty."

But there was a catch.

They sent him to Europe, and though he didn't participate in D-day, he was on the ground within thirty days of it. He said the tricky part of his duty was that the maps they had to work with didn't get down to the level of detail showing where that rock was and where the creek and the hedgerow were and all that stuff. So Dad had to put on black face paint and go out after dark, get across the lines, and memorize everything, then come back and get the maps done before morning because they were going to use them! He got the Bronze Star for it. So, that's where I get the ability to actually dimensionalize space; I inherited it from Dad.

All manner of serious training and comic propaganda films were animated by the Disney artists, from the satirical Donald Duck vehicle *Der Fuehrer's Face* in 1942 to the deadly serious 70-minute *Victory Through Air Power* released in 1943. For many students and film scholars it's the content of these wartime films that matters the most.

From the point of view of layout, however, what mattered about these particular animated shorts was the practical and creative discipline imposed by their restricted budgets. It was the studio's wartime drive for simplification rather than the planning and execution of complex multiplane scenes that, according to Bill Perkins, saw Layout finally becoming a distinct and recognizable department at Disney:

There's a layout paper trail for *Victory Through Air Power*: everything was documented, down to how

RIGHT: Poster for *Victory Through Air Power* (1943).

Sequence directors: James Algar, Clyde Geronimi and Jack Kinney



they incremented the movements of the different elements. A lot of notes were written at that time because they were documenting, for example, how you could take a single frame of a plane or a single drawing of a bomb and animate it by just sliding a cel, how you build a rig for that kind of thing, what it's going to do on the camera platen, and all of those details.

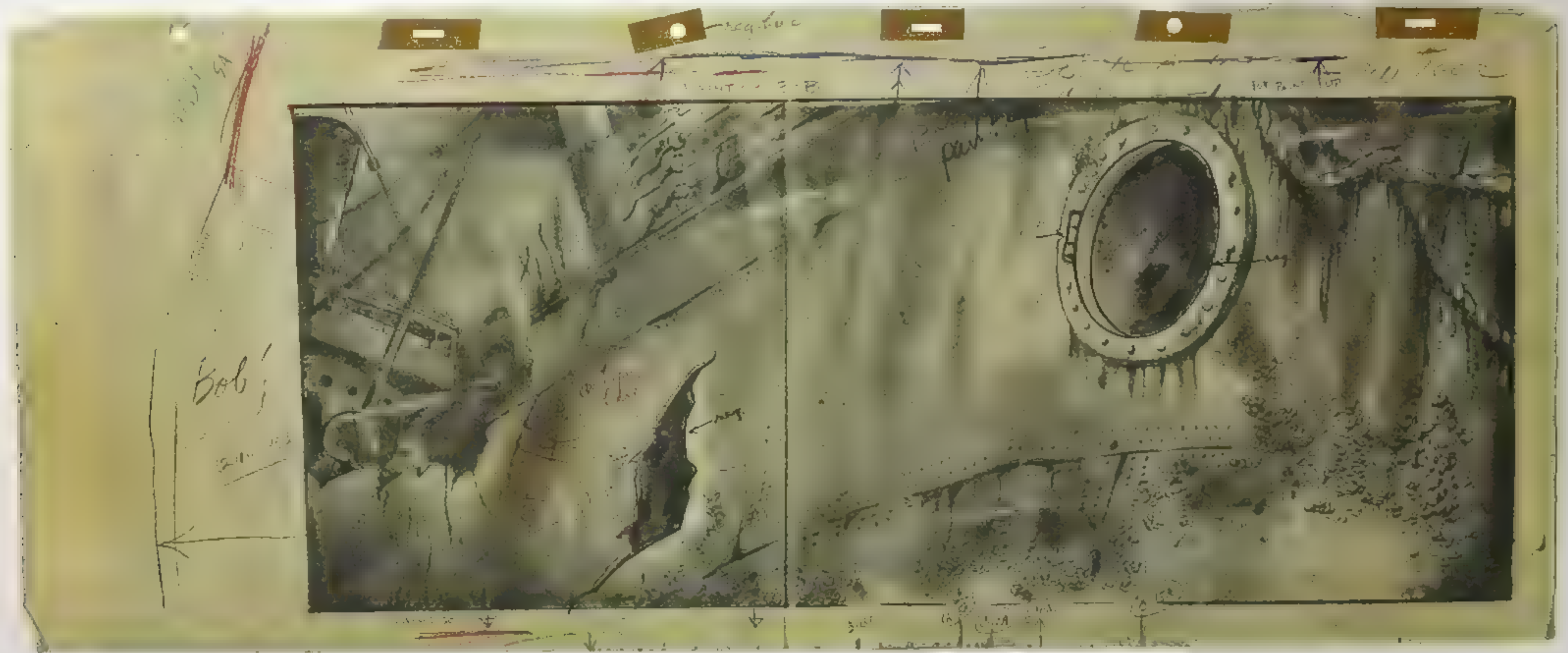
Perkins's assertion would seem to be borne out by the movie credits themselves. On *Saludos Amigos* in 1942, almost a decade before *Cinderella*, there were separate artist credits for Backgrounds and Art Supervision, but by *Melody Time* in 1948, Layout was routinely being listed as a distinct department by Disney, while Warner Bros. only began crediting their layout artists on the *Looney Tunes* shorts sometime in 1945.



2. HIGH ON THE WINGS OF VICTORY... IT'S THE ONLY STRIKE... THE WINGS ARE SOAKED AND SHAKING.



2. BUT THE VANGUARD IS NOT ALONE. BENEATH THE GLASSY WATER - COLDLY CALCULATING EYES -



TOP Original BG layout drawing.

layout artist credited, pens by Dick Bickenbach for
Supercop 2: Little Johnny, Inc. (1993) MCA Home Video.
[Directed by Tex Avery]

**MIDDLE Original background layout drawing by Dick Bickenbach,
designed so the camera can pan across the ruins of a bombed out
cathedral to find a miniature "mouse" organ in the rubble**

layout artist credited, pens by Dick Bickenbach for
Supercop 2: Little Johnny, Inc. (1993) MCA Home Video.
[Directed by Tex Avery]

**BOTTOM Original background layout drawing by Dick Bickenbach for
a panning shot of a burned-out cityscape with the ruins still ablaze**

layout artist credited, pens by Dick Bickenbach for
Supercop 2: Little Johnny, Inc. (1993) MCA Home Video.
[Directed by Tex Avery]



TOP In 1955 Hanna and Barbera decided to revisit the script and themes of Hugh Harman and Rudolf Ising's Academy Award-nominated short, *Peace on Earth* (1939), with their own anti-war cartoon, *Good Will to Men*; although this involved the creation of new characters and the design of layout artwork that could exploit the possibilities of the new CinemaScope anamorphic wide-screen format, many of the surviving character layouts were created on regular 12-field animation paper.

"ABOUT AS RIGHT AS IT GETS"

The absence of layout credits on any of the *Tom and Jerry* shorts produced during and after the war is perhaps strangest of all. A great many of the gags upon which these particular MGM cartoons depended were rooted in the slapstick opportunities that the beautifully observed domestic interiors, generously furnished with fridges, drapes, toys, and coal chutes, presented to the animators. In spite of this, for many years the MGM animation unit, which had been in existence since 1937, gave screen credit only to the lead animators, the producer, and the composer of the music.

Puzzled by this fact, I was delighted to be able to track down layout artist Harvey Eisenberg's son, Jerry. Like Drew Gentle, Jerry had followed his father into the animation industry and chosen a career in layout. He was only too aware that his dad's name had never made it onto the screen:

There are no layout credits on the old *Tom and Jerry*s and *Droopys*. There's the writer and the animators and that's it.

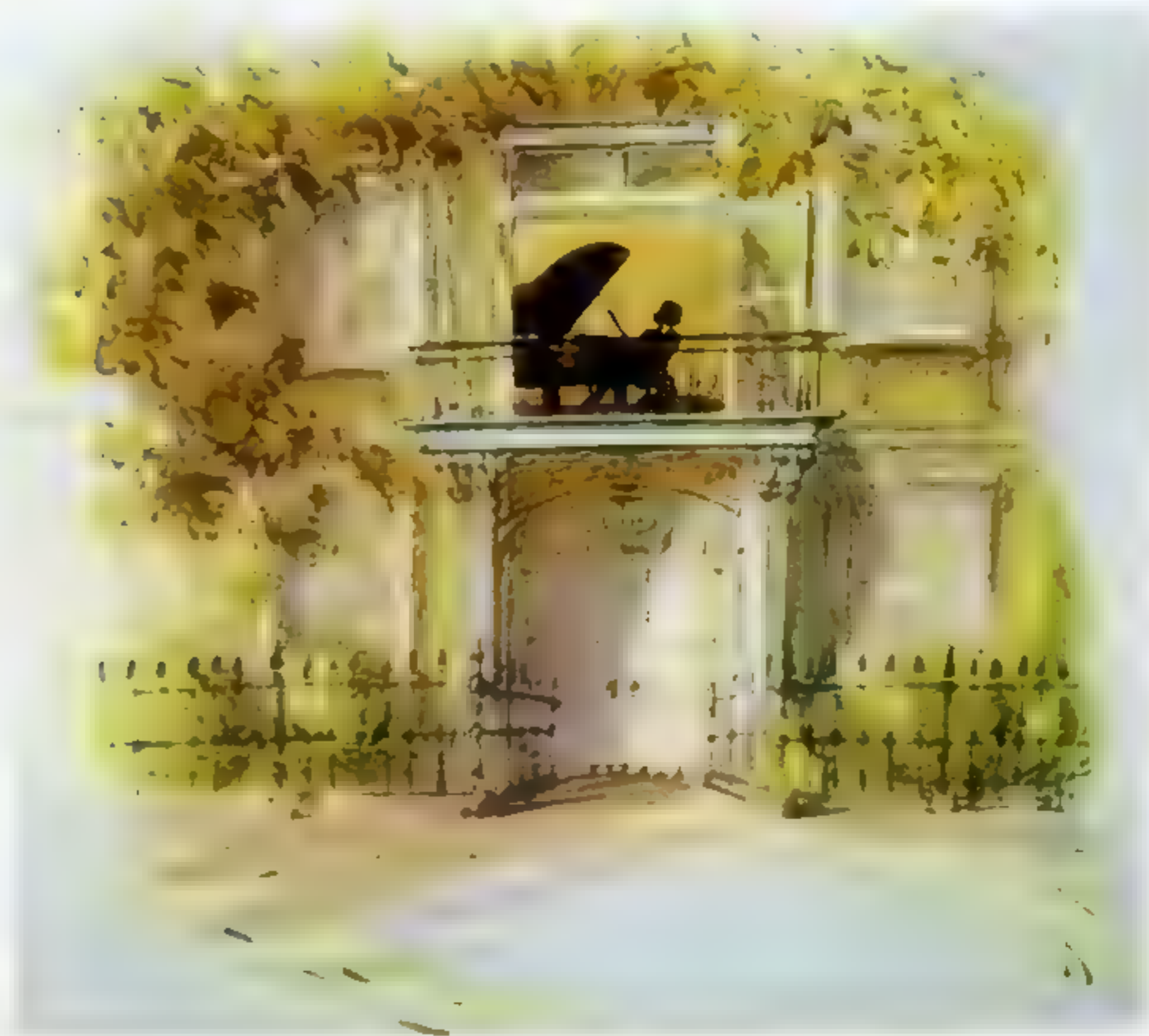
Drew, whose own admiration of the artistry of the Harman-Ising⁴ and MGM cartoons remains undimmed, had at least been given the pleasure of seeing his father receive credit as background painter from time to time:

Back then, obviously, the director had a credit in a separate panel. But in the beginning Dad did get credit. I'd say about 50 percent of them had his name [in the on-screen credits].

Dad went to the Otis Art Institute, the old school right off MacArthur Park. He went to work at the studios pretty early. He started at Harman and Ising in the '30s, just in time to work on the original *Peace on Earth* (1939). That's where he

Original pencil layouts by Dick Bickenbach
Good Will to Men (1955) MGM Cartoons
Directed by William Hanna and Joseph Barbera
LEFT Scene 6 Organ & outline, character layout
RIGHT Scene 6 Organ tonal sketch, pencil layout

BOTTOM Preliminary watercolor study by Robert Gentle for background painting, scene 2, "Johann Mouse."
Tom and Jerry, "Johann Mouse" (1952) MGM Cartoons
Directed by William Hanna and Joseph Barbera



A vertical row of numbered "notches" indicating the desired, frame-by-frame incremental movements of the sliding peg bar on the compound table can be seen marked by the artist along the right-hand side of this BG layout.

Original BG layout drawing

(layout artist uncredited, possibly by Tex Avery or Dick Bickenbach)

Scene 2, *Señor Droopy* (1949) MGM Cartoons

FOLLOWING SPREAD: Original layout, background, and cel artwork for one of the later cartoons in the *Barney Bear* series, which ran from 1939 to 1954.

Background painting by John Didrik Johnsen

Layout artist unknown

Barney's Hungry Cousin (1953) MGM Cartoons

Directed by Dick Lundy

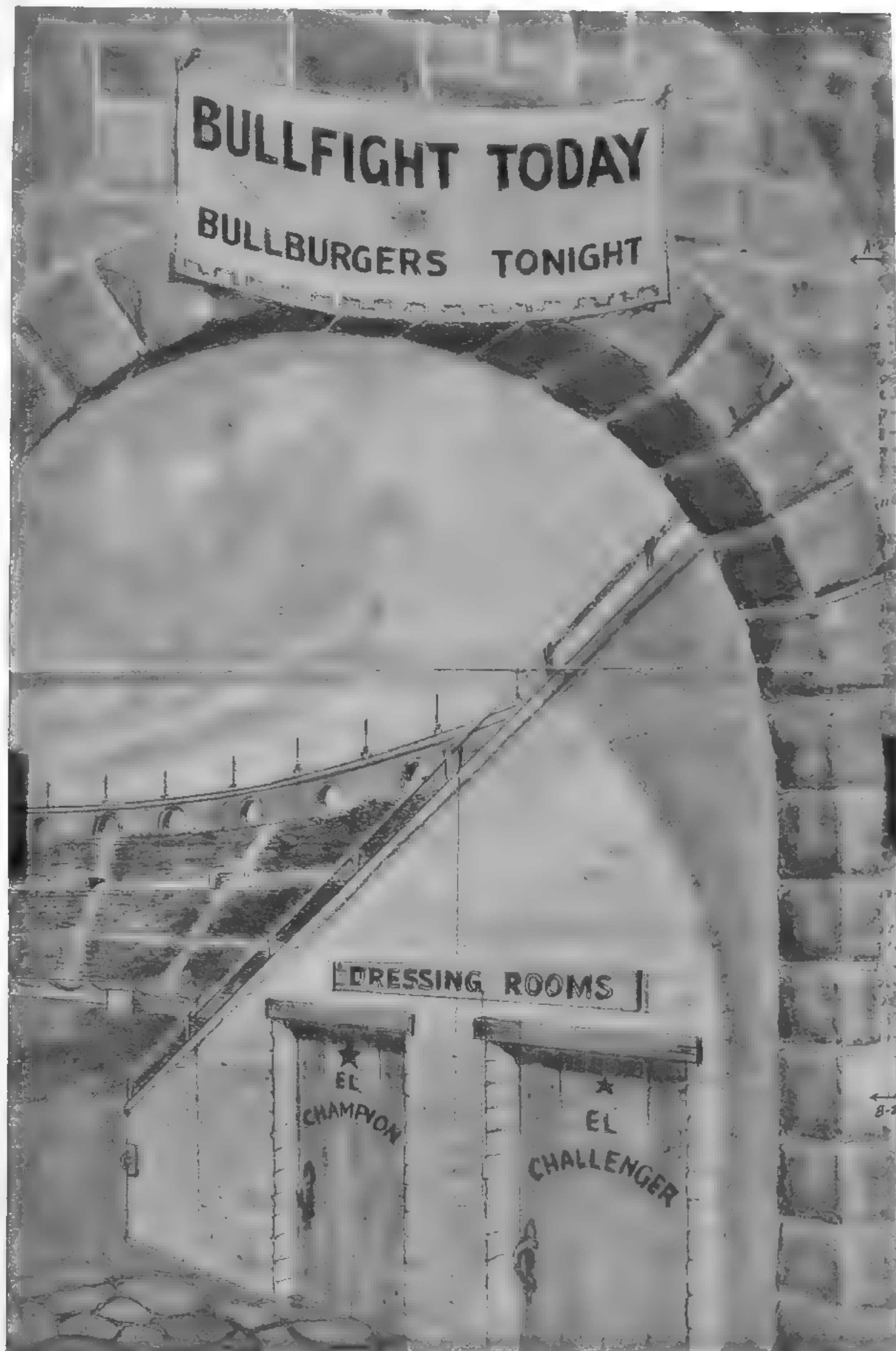
Produced by Fred Quimby

met Bill Hanna and Joe Barbera, and he just transitioned with them over to MGM. A lot of my dad's first experience was doing backgrounds for the old *Barney Bears*, which are wonderful old cartoons, full of expression and so well animated.

Harvey Eisenberg, who had joined the Fleischer Studios in New York as an animation inker when he was eighteen, eventually left the animation side of the business to concentrate on illustrating comic books that often featured the characters made popular by the MGM (and later the Hanna-Barbera) cartoons:

Dad started in animation in the early '30s. I remember later, when he did his comic books, I used to watch. He was so good at inking—he would draw, ink, and letter—that one of the old-timers in the business who knew him years ago told me he was such a great inker (with a brush, too) that they kept him back because of it. Dad wanted to move into animation, into inbetweening and assisting at Fleischer, but they kept him back because he was so good at inking! There's so many things I never thought to ask him, but I'm sure my father probably left to go to a studio that would let him do inbetweens.

My dad came out to California before us; we were all in New York. Joe Barbera came out here first. My dad always kept in touch with Joe because they used to work at the same studio and they both had lived in Brooklyn so they used to travel to work together. Anyway, Joe said, "Come on out to MGM!" so my father came out. Joe and Bill had become directors there so Dad was the layout man for their unit. The cartoon studio was on Lot 2, right on the corner on the other side of Overland Avenue in Culver City. He was there from 1939 or thereabouts 'til about '45.



← MOR. LINE



Hank STONES
 WILSON, TENN
 & TRICE (MD)
 SC ANIMATED

Johnny
 H... S...
 ANIMATED ONE
 H... W...

FATHERE
 FREE
 PICNIC GROUNDS

PRID No 277	ANIMATOR	
SC NOS.	STILL 0	FIELDS
LA	11/10	
CHECK	UAG	125



EAT HERE
FREE
PICNIC GROUNDS

TOP: Original BG layout drawing, Rialto cinema exterior.
(layout artist uncredited, possibly Tex Avery or Dick Bickenbach)
Scene 29, *TV of Tomorrow* (1953) MGM Cartoons
Directed by Tex Avery

BOTTOM: *World's Fair Poster* (1939).
(artist unknown)

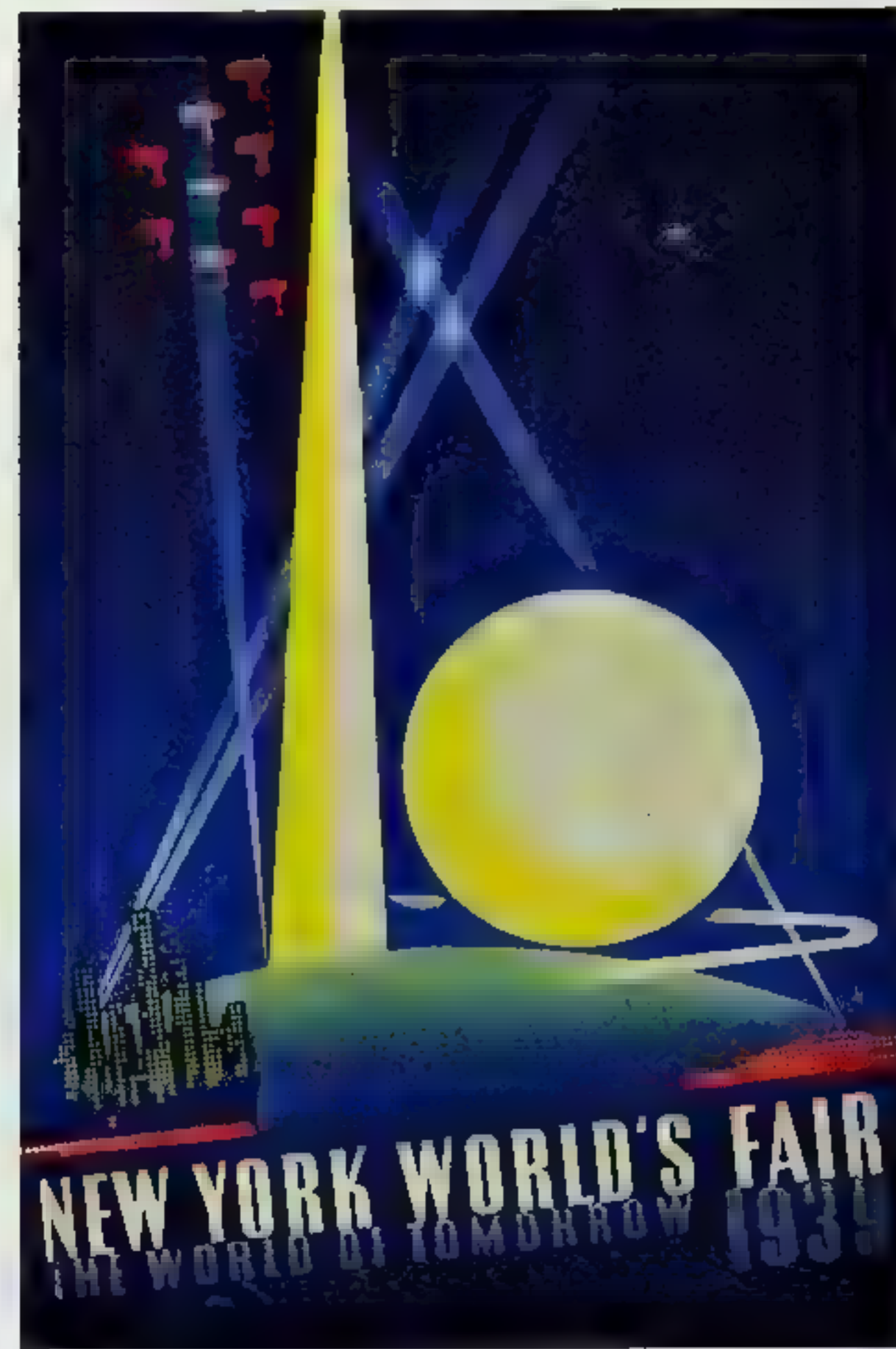
Barbera himself had continued to design and draw background layouts at MGM, until the pressure of work forced him to delegate to artists like Eisenberg and his coworker and successor, Dick Bickenbach; this in itself may have been the reason for the absence of a layout credit: if one of the director's own jobs was to lay the picture out, why credit him twice? Curious nonetheless about the division of labor at the time, I asked Jerry if his dad would have done both character and background layout:

He did both. In his comic books, he had such a nice flow in his drawings from panel to panel. A lot of people said this and I could see it too; they all used that word "flow." And he was great with character posing.

When I asked animator and historian Mark Kausler, who came to know Hugh Harman in the early 1970s, if he believed that layout was something that it was important for students in particular to get right, his response was clear:

Well, yes. Of course, in talking about MGM layout, that's about as right as it gets! They had an animator called Bob Allen, who worked with Hugh Harman and Rudy Ising, and he did a lot of the original pose reels. For instance, his pose reels for *Home on the Range* [1940] and *The Midnight Snack* [1941] both still exist.

Shortly after the turn of the millennium, Tony Cervone and Spike Brandt, now a successful directing partnership at Warner Bros. Animation, had the chance to learn something of the original approach to character layout, pose reels, and timing at MGM. Tony describes Barbera's working methods:



We worked with Joe Barbera on some of his last projects here at Warner Bros., and we followed the way that they had made the MGM cartoons before: at least for the character layout stuff, Joe Barbera actually laid out the first few *Tom and Jerry* cartoons himself, but later on he would write these things in a storyboard, which was a piece of animation paper divided into four quadrants; then he would work with Harvey Eisenberg, his character layout man, and they would basically produce all the layouts for the cartoon. I actually have some of Joe Barbera's originals with notes on them to Dick Bickenbach, who followed Harvey.

So then they would hand that stack over to Bill Hanna, who would time it all out. Then they would shoot a Leica reel to length, a pose test of just the character layouts, and then show that to people at the studio to get the audience response. After that the sheets would be done by Bill Hanna; then he would supervise the animation while Joe Barbera was working on the next *Tom and Jerry* cartoon. So they actually shot the whole cartoon in layouts first to make sure that the cartoon was going to work before it went into animation.

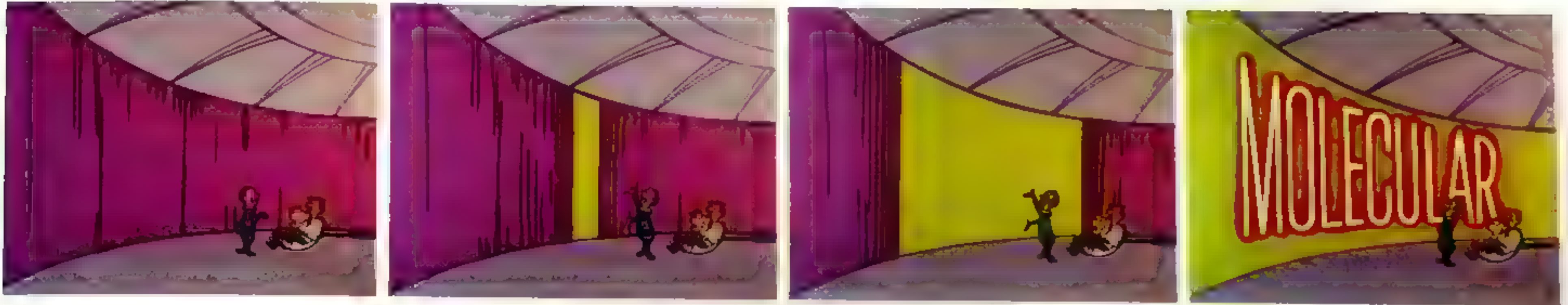
Some of the most beautifully rendered pencil layout artwork to have survived from the MGM Studios came from the shorts directed by Tex Avery although, again, Avery's nondirectorial input went uncredited. Brandt confirmed, however, that by the 1950s Warner Bros. had taken to crediting layout artists Hawley Pratt (working with director Friz Freleng) and Maurice Noble (working with Chuck Jones) as codirector on some of the *Looney Tunes* and *Merrie Melodies* shorts in recognition of their importance not only to the look but also to the pacing and structure of the films.

The war seems to have had some kind of influence on MGM, too, in terms of on-screen

TOP A salesman tries to impress George and Jane Jetson with a gigantic widescreen display not unlike the Cinerama and CinemaScope projections being shown in cinemas at the time. "The Space Car" episode 4 *The Jetsons* Season One (1963) Hanna-Barbera Studios

MIDDLE Visitors to the 1939 World's Fair admire a specially manufactured model of the RCA TRK 12 television set, displayed in a transparent "Lucite" casing.

BOTTOM Idealized publicity shot for RCA's TRK 12 domestic black-and-white television set (circa 1939).

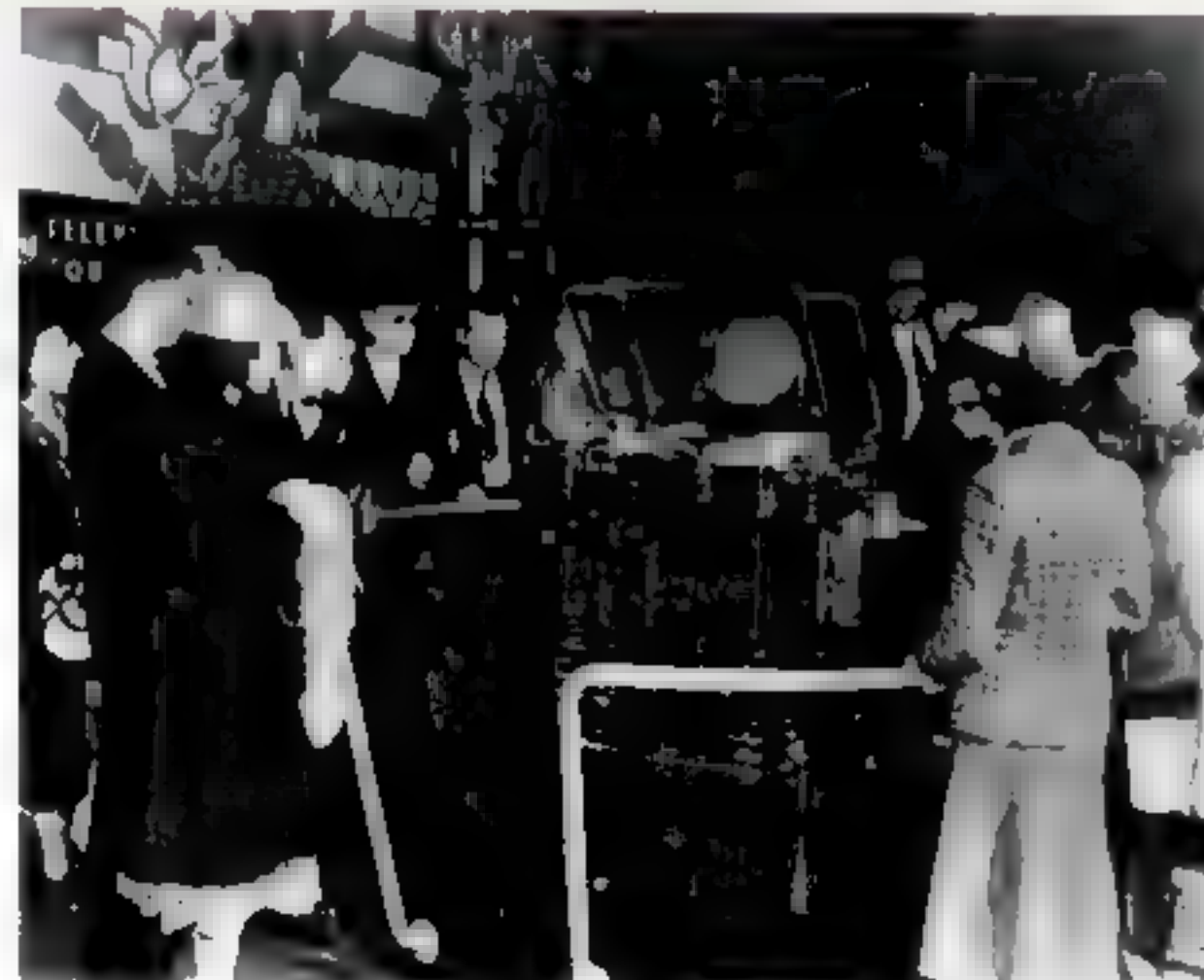


recognition for layout skills; while *Peace on Earth*, Hugh Harman's 1939 antiwar parable, listed no artists at all, Dick Bickenbach is given full credit as layout designer on *Good Will to Men*, Hanna and Barbera's 1955 reworking of the short, perhaps in recognition of the additional demands of the film's CinemaScope format.

Indeed the screen ratio itself is a reminder of the technical innovation that had the single greatest transformative influence on animation design prior to the emergence of affordable computer modeling software: television.

THE PICTURE BOX: DESIGN SHRINKS TO FIT THE TV

Before going into seven years of war-enforced hibernation, the invention that was to redefine both entertainment and commerce in the later part of the twentieth century had been unveiled at the New York World's Fair in 1939 by Franklin D. Roosevelt when he helped launch RCA's pioneering TRK-12 domestic television apparatus. Between 1947 and 1955, with the war over and the domestic economy booming, it's been estimated that more than half of the households in America had managed to acquire a set from RCA or one of its competitors.² Most commercial programs in the United States, however, continued to be broadcast in black and white well into the next decade, with color programs only making a widespread impact from the mid-1960s onward.

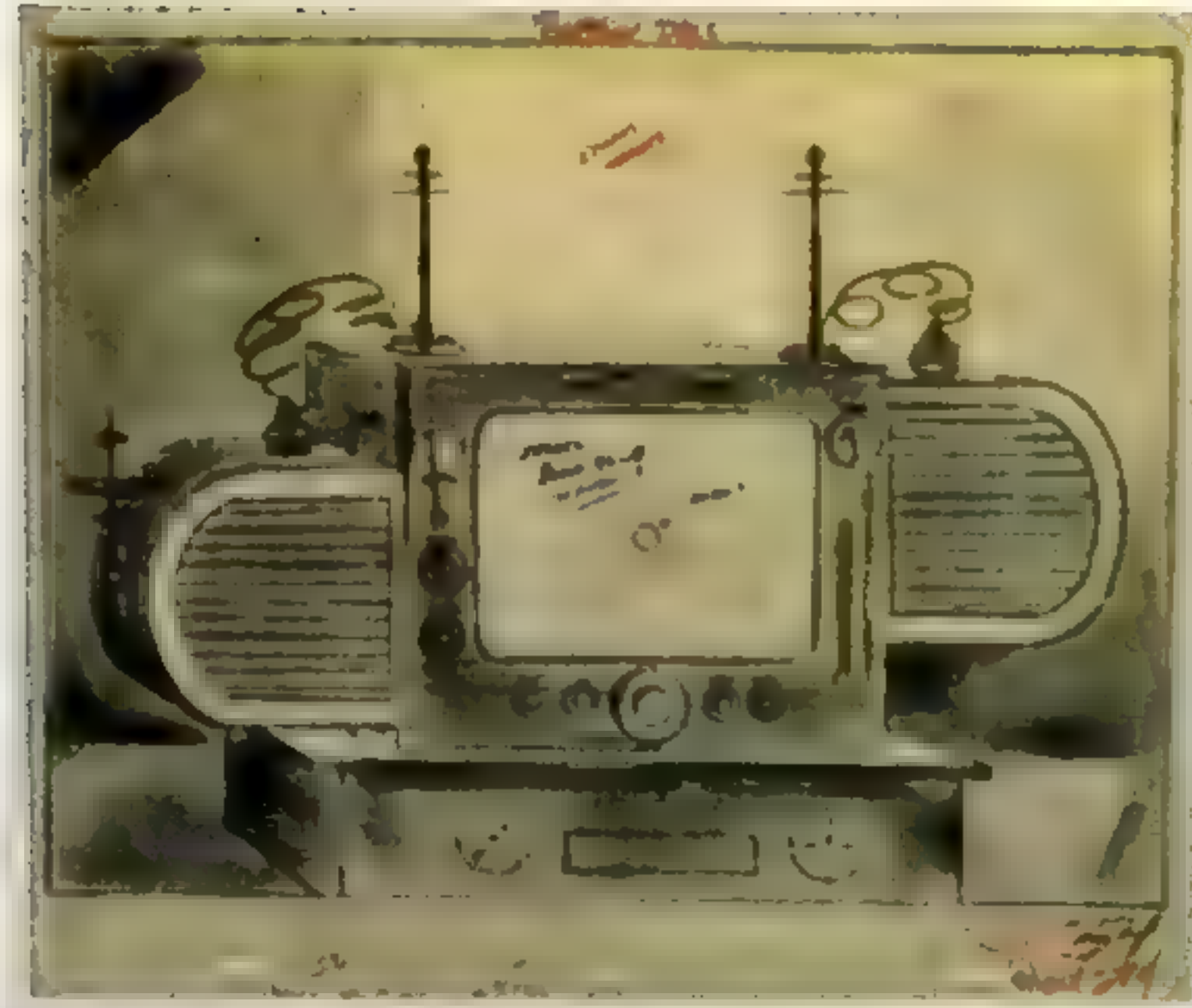


Intimidated by declining cinema attendances and worried that families might never again leave their homes in sufficient numbers to keep the cinema viable as a mainstream entertainment medium, exhibitors began hurrying to fit expensive new projection systems capable of delivering bigger, wider-screen images in an effort to provide the kind of large-scale spectacle that no meager 9- (or even 24-) inch screen could hope to compete with.

With wide-screen high-definition broadcast images now so commonplace, it's important, as we look back, to appreciate just how significant the change was to the increasingly panoramic images people were exposed to on the 1950s cinema screens, many of which were several times the size of a modern-day multiplex screen.

Opened in the early 1930s and built to accommodate an audience of nearly 6,000 people, the auditorium at Radio City Music Hall in New York was so large that the projectors were fitted with specially manufactured bulbs that could throw the beam across the diagonal of a New York City block. The original Cinerama™ system first introduced in 1952 required movies to be filmed with three separate cameras and then exhibited on specially designed "deep curve" screens with three projectors running in synchronization. The Gaumont Cinema in Bournemouth and the Odeon Marble Arch in London, both of which had been fitted

LEFT Pencil layout drawing of a futuristic TV set.
(layout artist uncredited, possibly by Tex Avery or Dick Bickenbach)
Scene 54, *The TV of Tomorrow* (1953) MGM Cartoons
Directed by Tex Avery



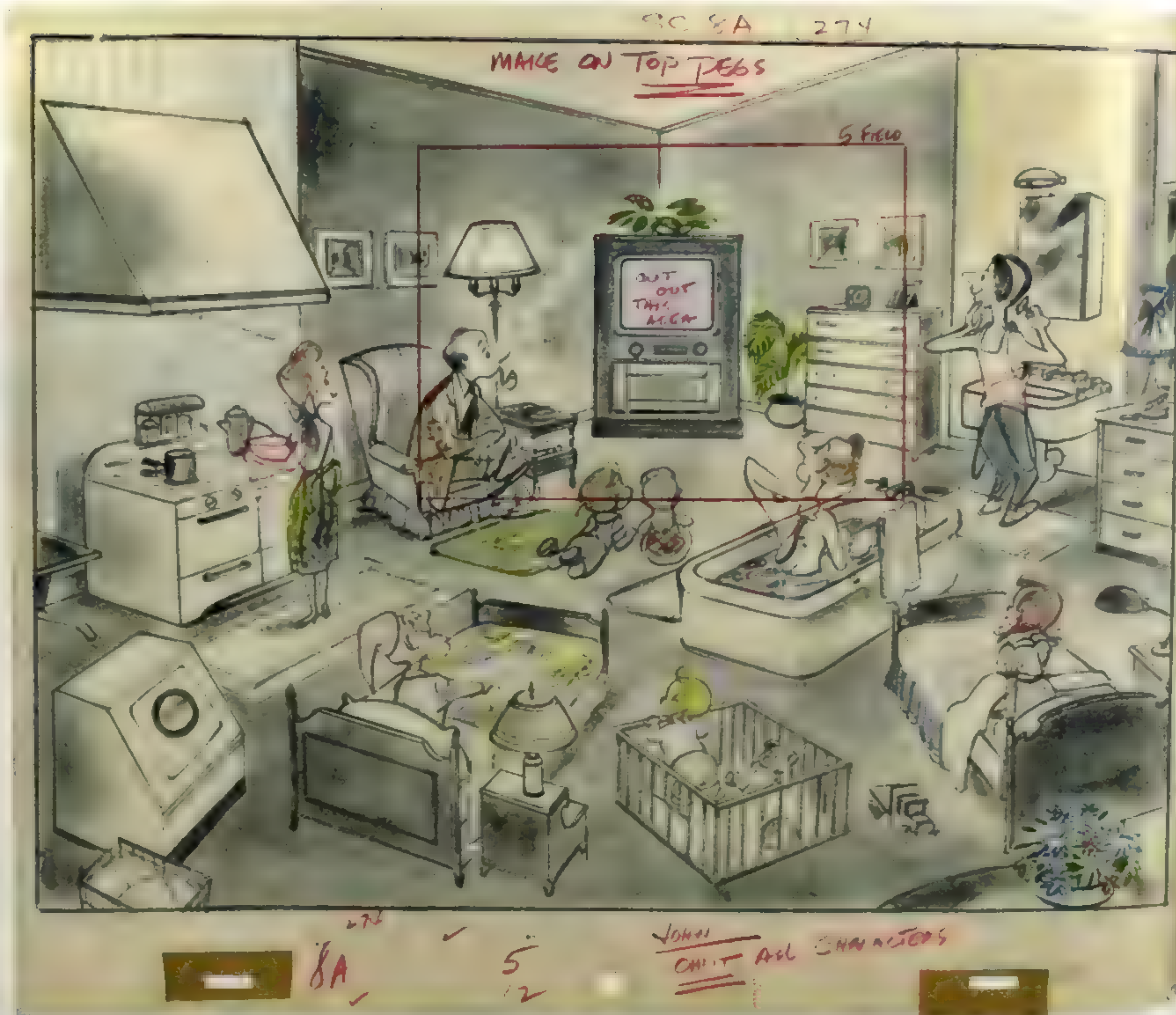
with broad, curved screens to meet the needs of the later single-projector version of the Cinerama system, eventually returned to flatter, more rectangular screens that were several stories high, effectively the same elevation as the surrounding buildings.³

Color, of course, had long been a part of the movie experience, but the new wide-screen cinema formats presented animation designers with a double challenge: while the animated TV series was not to take off until the arrival of Hanna-Barbera's groundbreaking *The Flintstones* in the 1960s, the design and preparation of animated shorts, title sequences, and commercials for TV required artists to accept once again the limitations of working in grayscale.

Long after color television became more affordable, enough black-and-white sets remained in circulation that it continued to be vitally important for designers to make sure that all their on-screen images could be read clearly, no matter which kind of receiver the viewer might have access to. There were, of course, many designers, particularly in the freelance pool, who now had to shift backward and forward between both sets of design criteria.

RIGHT Original background and character layout drawing showing a less idealized home setting than the RCA promotional photographs of 1939; every member of this large extended family is engrossed in watching the TV, which has been given pride of place at the center of their apartment.

(layout artist uncredited, possibly Tex Avery or Dick Bickenbach)
Scene 8A, *The TV of Tomorrow* (1953) MGM Cartoons
Directed by Tex Avery



TOP LEFT Often we glimpse a television image, no matter how expensive or detailed, for only as long as we might glance at a traffic light or a speed sign.

Illustration by Arminio (Art) Lozzi, 1960s. © Lozzi. All rights reserved. Reproduced by permission of the artist. www.artlozzi.com



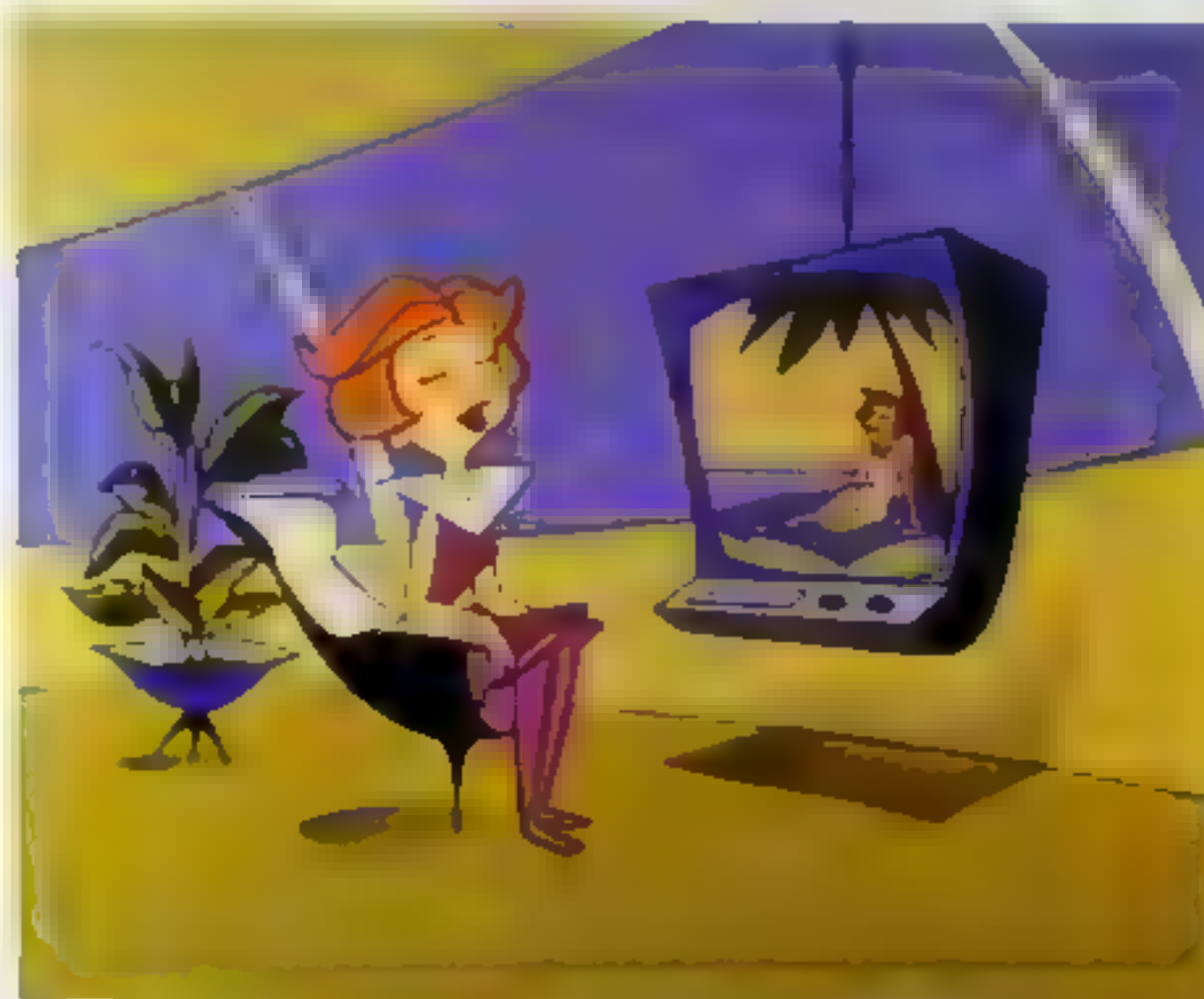
BELOW Just as the earliest animated characters had often been portrayed as theater performers and theatergoers, so the animated characters of the 1960s appeared on screen as both stars and viewers of the new medium of television.

TOP: Jerry the mouse from *Tom and Jerry*, 1960s. © Lozzi. All rights reserved. Reproduced by permission of the artist. www.artlozzi.com
MIDDLE: *The Flintstones*, 1960s. © Hanna-Barbera. All rights reserved. Reproduced by permission of the artist. www.hanna-barbera.com
BOTTOM: *The Flintstones*, 1960s. © Hanna-Barbera. All rights reserved. Reproduced by permission of the artist. www.hanna-barbera.com



But many found themselves working once again within the confines of the 3:4 image format that had been familiar to cinema audiences way back in the '20s and '30s (*Snow White*, for example, was photographed with an aspect ratio of 1.33:1). So while cinema art directors and production designers were encouraged to stretch their skills and their crews to meet the challenge of all this extra on-screen space, and while lens designers and live-action camera crews labored to bring an entirely new kind of panoramic scope to their image-making, the advent of television meant that the animation designers were required to cater to the reduced image quality that the linear fizz of a cathode ray tube imposed and to a screen format that had gone, in a few short years, from being the size of a house to having roughly the same dimensions as a road sign.

For many of the artists, however, such apparent practical disadvantages were far outweighed by the creative challenge and raw excitement of breaking ground in a new medium, as was clear from background artist Arminio (Art) Lozzi's enthusiastic description of the working atmosphere at the time. Having impressed both Hanna



and Barbera with his fine-art portfolio as a recent UCLA graduate, Lozzi had started out by taking a summer job as an inbetweener at MGM shortly before the 1957 winding-down of the studio. As a relative newcomer to the industry, the excitement of being invited to help the duo establish their new business was still clear in his voice when we spoke, almost fifty years after the event, hardly surprising when you consider that his team included not only Bob Gentle but additional MGM veterans Fernando Montealegre and Ed Benedict (the latter described by Lozzi as "the tops"):

Bill Hanna knew that I was a fine-arts painter and asked me if I would join them when they started the new television [animation] studio. They were doing color, not black and white, which was wonderful for television; Bill asked would I consider helping to form the Background Department?

We were in all only fourteen people; it was a small studio at the old Charlie Chaplin Studios on LaBrea [before] they continued with a new studio on Cahuenga. So, that was it! And I got involved with backgrounds on *Yogi Bear* and *The Flintstones* and that crowd. We became "the Backgrounders"!

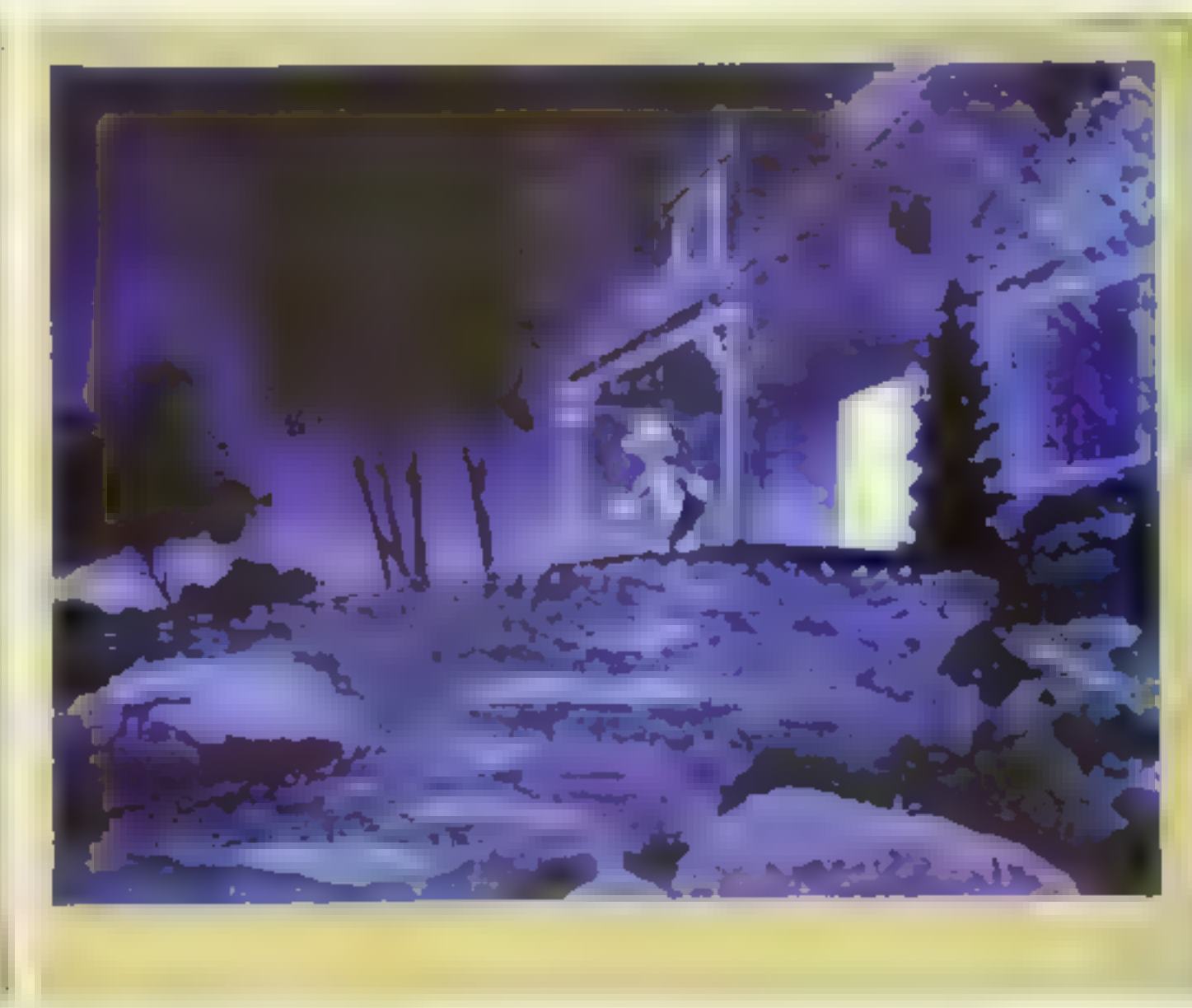
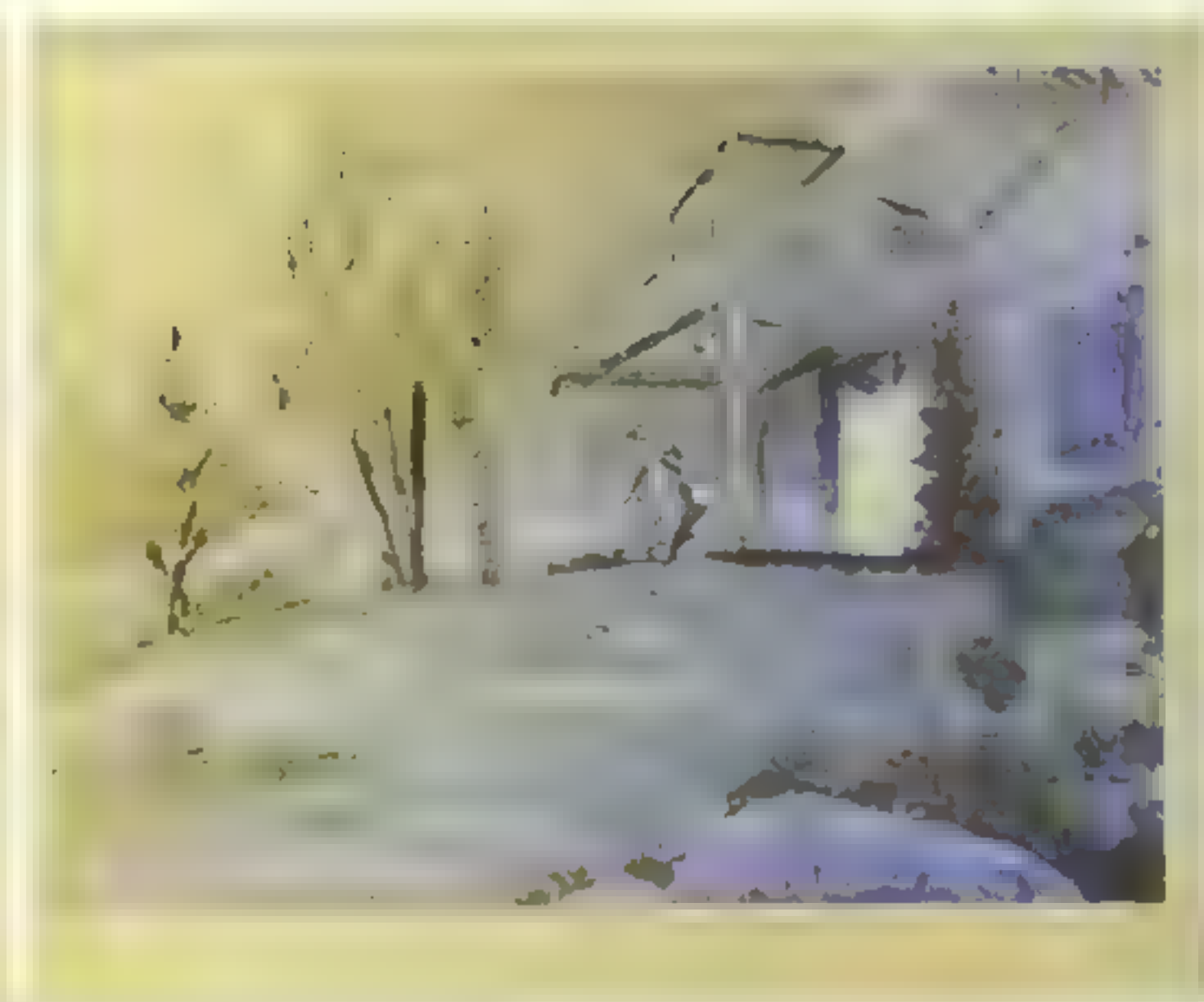
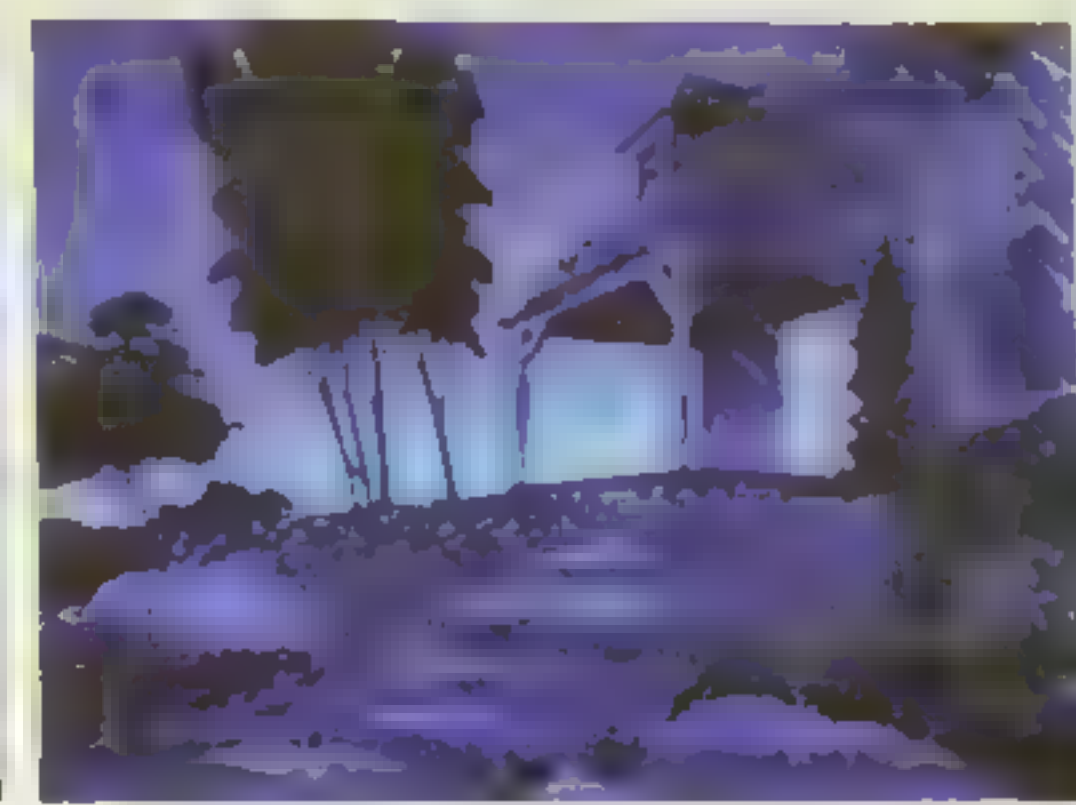
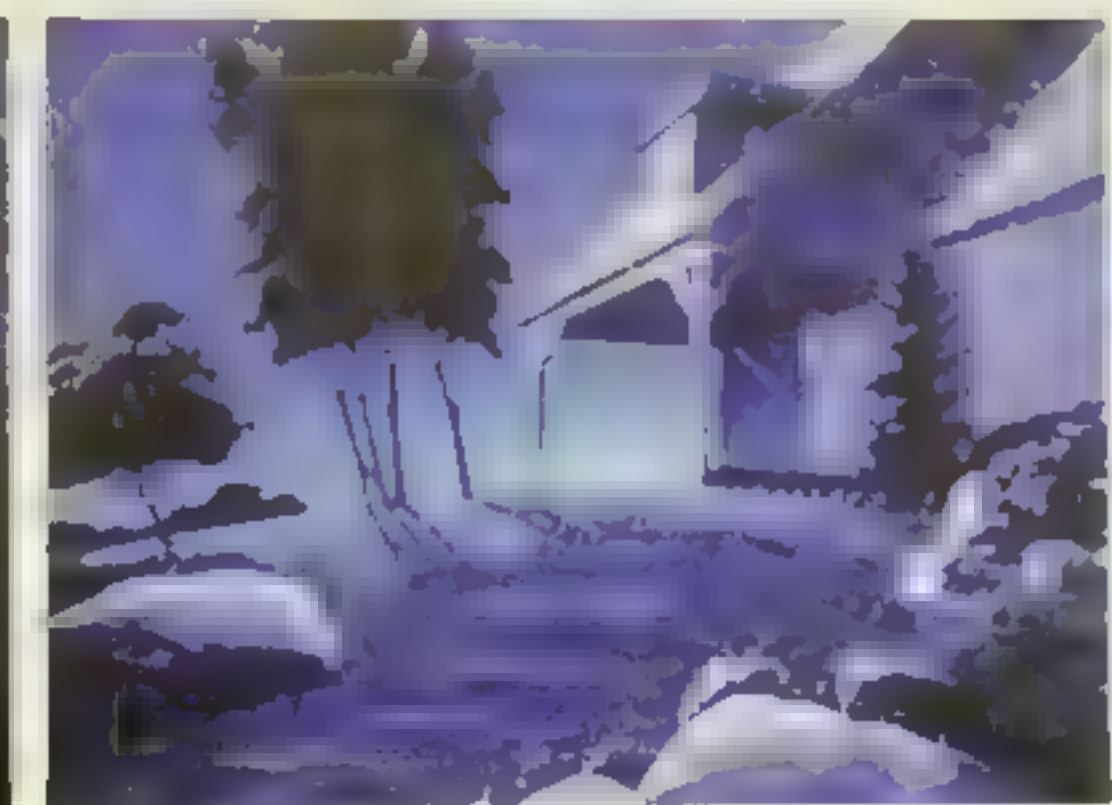
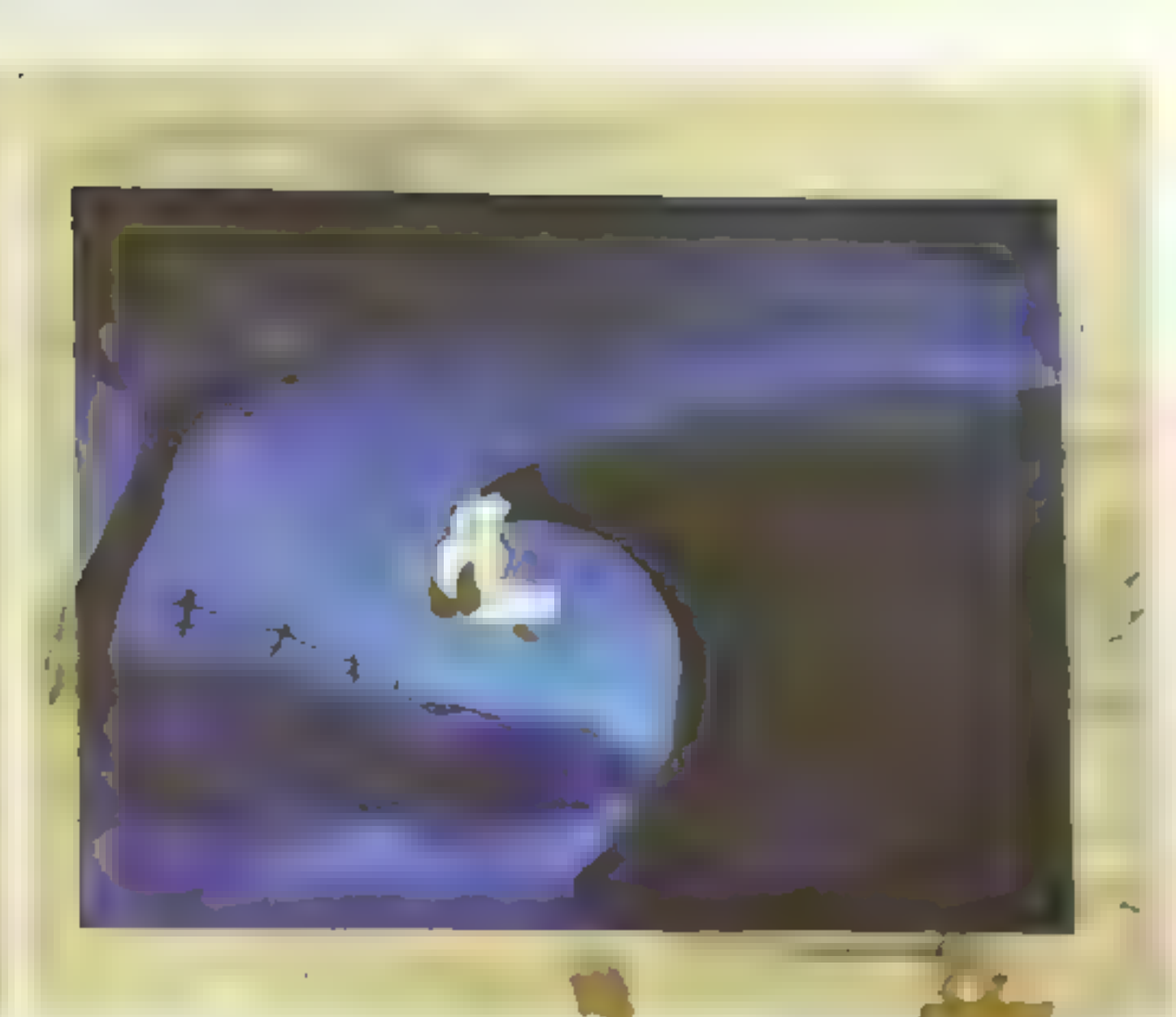
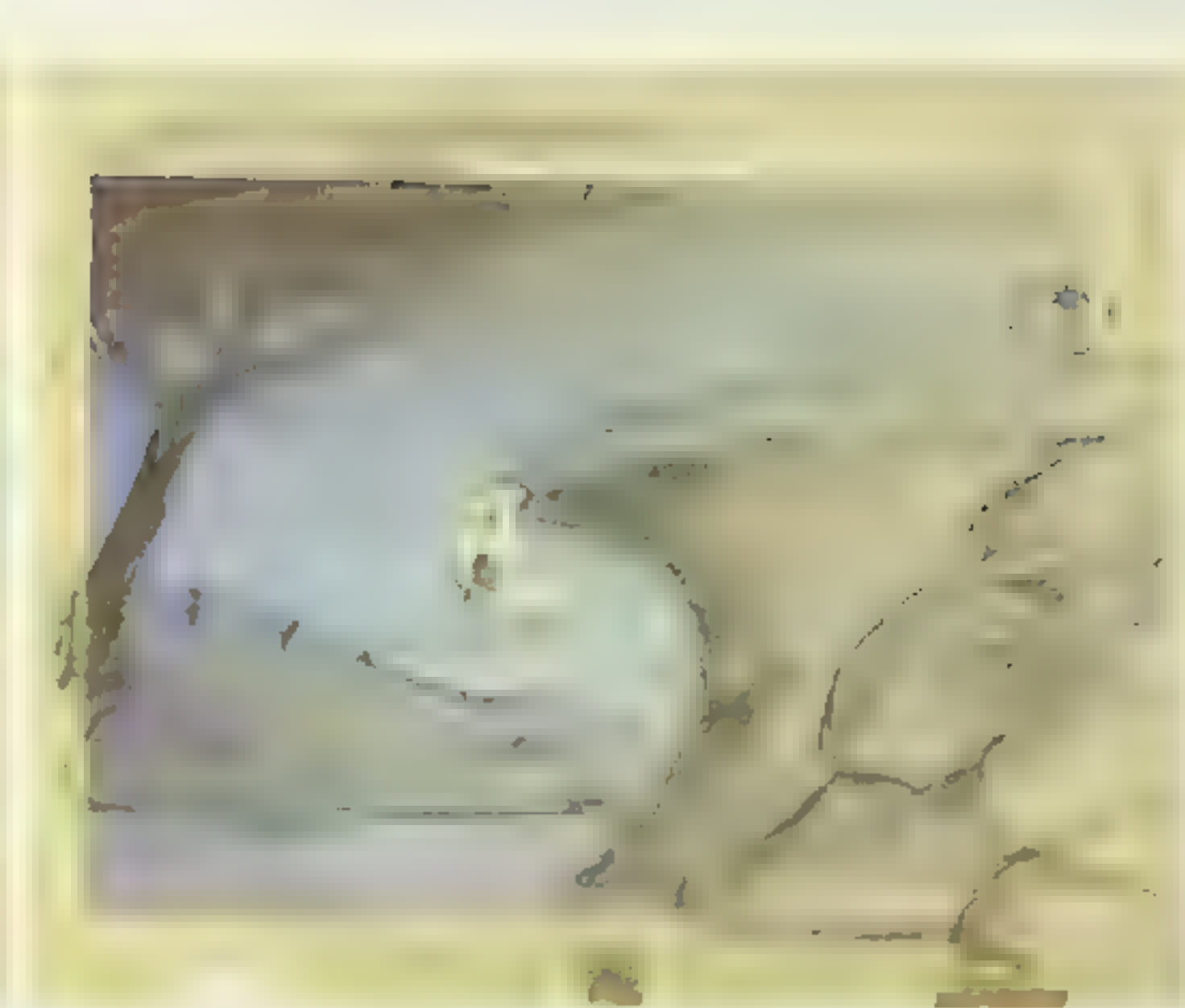
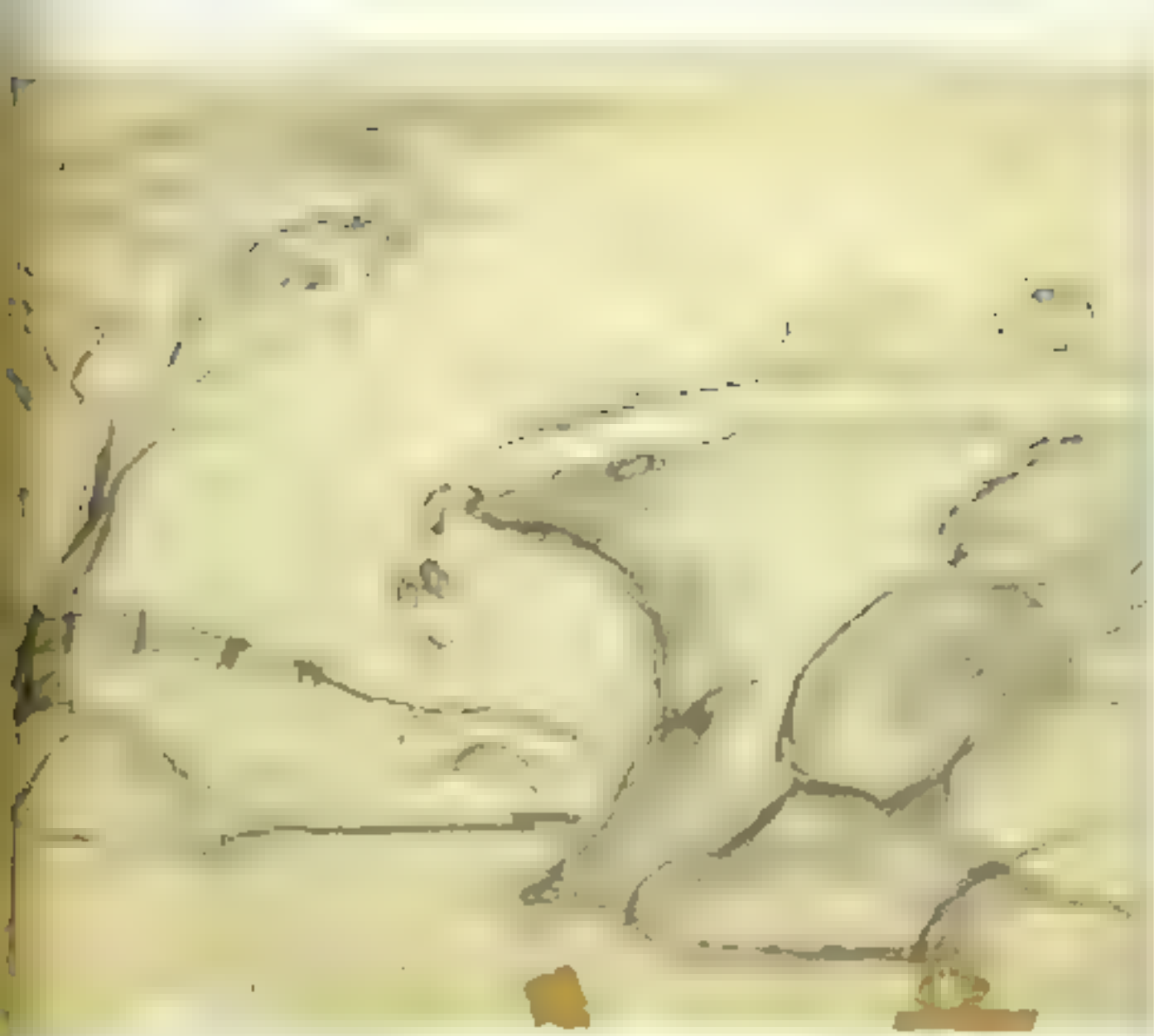
We were given the basics of a layout; there were necessary lines that had to be followed, the paths of action, and the registration lines. And sometimes not just a line, a whole door or a cave entrance perhaps, or a bush or a tree. Those lines we honored, of course. But there simply was not time. We had to churn out backgrounds, a couple a week. So, it wasn't like at Walt Disney's where they took weeks to do one scene.

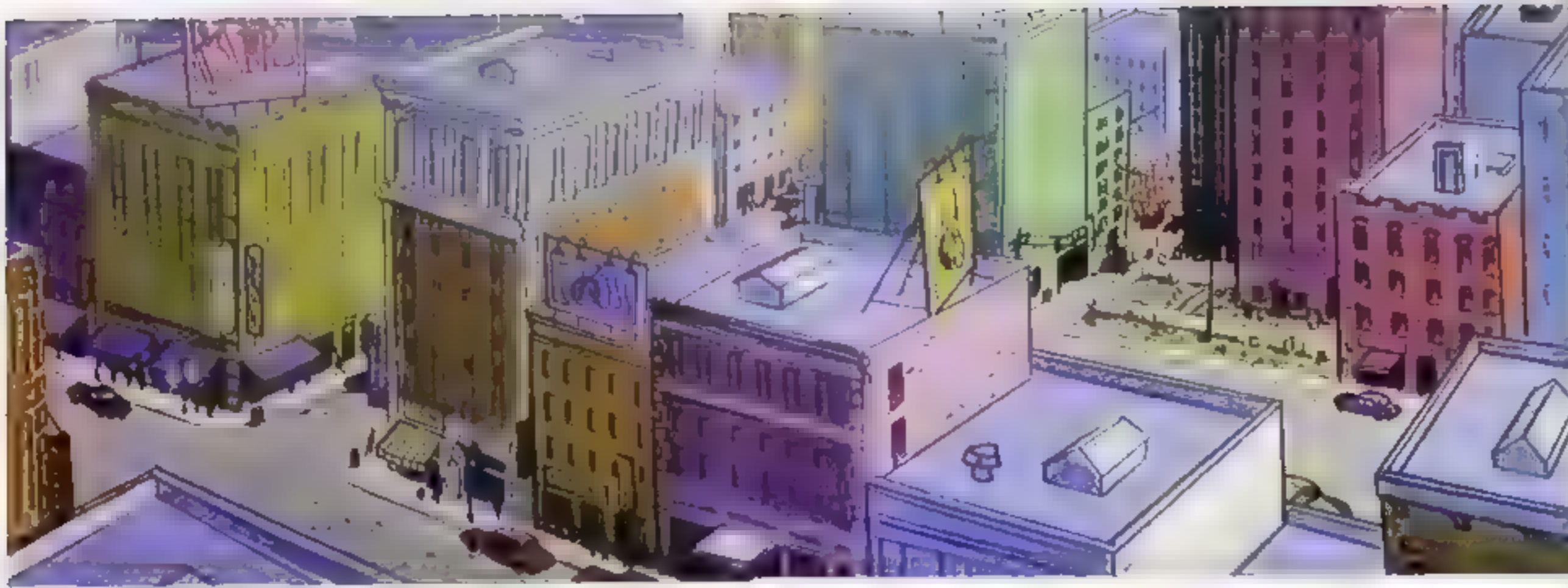
Favoring neither cinema nor broadcast aspect ratio, *Lady and the Tramp* was released in both 1.37:1 and 2.35:1 versions.

As part of the economy of the new medium of TV, animated characters were seldom shown moving away from (or toward) the camera in perspective. Cycles of painted character cels were easier to reuse if the action was designed to play from one side of the screen to the other, hence the large number of lengthy panning backgrounds used in TV cartoon production.

OPPOSITE These two scenes show how directly MGM background artist Johnny Didrik Johnson was able to translate even Joe Barbera's roughest pencil outlines into a final painted background composition without any need for an intermediate "clean up" layout drawing.







Even as late as the 1970s, significant numbers of domestic TV sets worldwide were only capable of receiving a black-and-white signal. Like most painters and illustrators since the Renaissance, animation artists therefore had to establish the tonal values of their artwork in monochrome before introducing a specific palette of colors. In the words of Hanna-Barbera BG painter Art Lozzi: "Black-and-white grades are very very important. Actually there is no 'black-and-white,' it's just untuned color."

TOP AND BOTTOM BG for establishing pan shot, city overview with Top Cat's alleyway center right
 "TC Minds the Baby" episode 17 (and others).
 Top Cat (1961) Hanna-Barbera Studios
 Produced and directed by William Hanna and Joseph Barbera
 Layout by Jack Huber
 Background by Fernando Montealegre

designing, and it's important to emphasize these particular developments because television rapidly became the medium through which younger audiences encountered both cinema and television content. This very collision of styles within one readily accessible "box" is all too easy to dismiss (or accept unquestioningly) if we don't stop to consider all of the reasons why, for example, Hanna-Barbera's *Top Cat* looked so unlike Disney's *Lady and the Tramp*.

Disney's decision to move into feature production in the late 1930s had been underpinned by serious economic considerations. It was simply impossible to sustain a full-time studio staff on the returns from animated shorts, and *Snow White's* success had been followed by the failure of *Pinocchio* (1940), *Fantasia* (1940), and *Bambi* (1942) to break even on first domestic release, so it was fortunate that, long before its unveiling at the 1939 World's Fair, Walt had been prescient enough to take note of the emerging technology of television.⁴

Bill Hanna and Joe Barbera's decision in the late 1950s to mark out territory for themselves in television was rooted in similar practical concerns. Disney's exemplary success in the medium had begun in 1950 with the lavish NBC Christmas Special *One Hour in Wonderland*, but with neither feature movies nor a theme park to promote, Hanna and Barbera sought instead to establish a working unit capable of creating half-hour animated comedy shows tailored to what, by then, was the established broadcast format for a series.

With many years of experience and success behind them in the production of the *Tom and Jerry* shorts in particular, they knew that

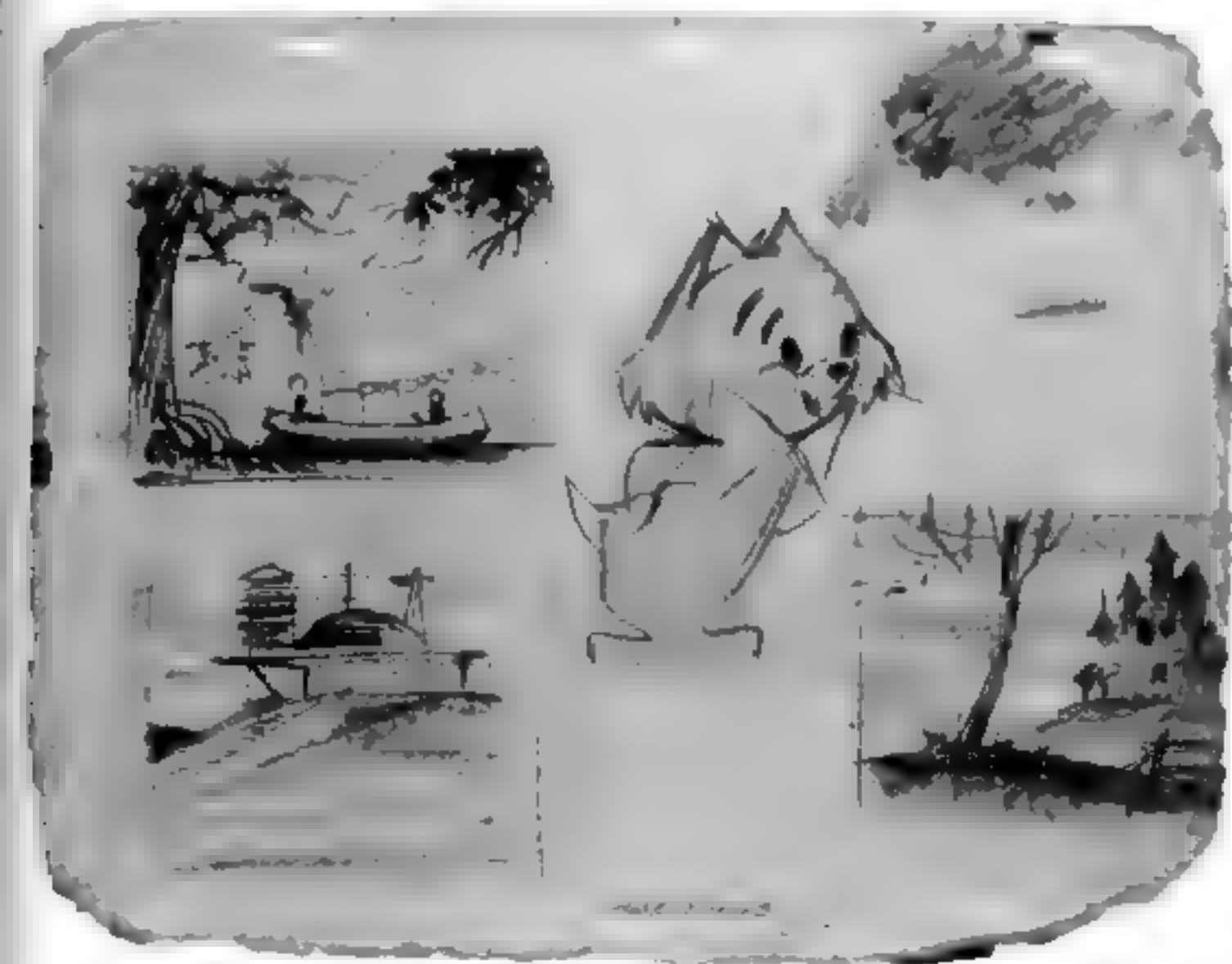
DIVIDED ATTENTION

There were other limitations that the artists had to consider when designing and animating for this new medium: we part with our money at a movie theater box office knowing that we'll be sitting in the dark for a couple of hours, watching a specific movie. But competition between the major commercial networks and local independent stations quickly led to a situation in which American viewers had a wide variety of possible TV channels to choose from. While it was a nuisance to get up and leave the theater if you didn't like the movie you'd paid to see, it took almost no effort at all to rotate a dial in the privacy and comfort of your own living room to look for an alternative TV program.

This growing consumer freedom meant that it became harder and harder for program-makers to be confident that they could hold the viewers' attention. If we also factor in the (then novel) idea

that while watching a TV program at home, people were completely at liberty to cook a meal, have a conversation with somebody over the telephone, or perhaps even try to do all three things at once, it becomes easy to see why some of the subtlety and sophistication to which audiences had become accustomed in design and animation for cinema fell by the wayside in the early years of television. This is not to suggest that things took a dive universally or irretrievably in terms of either content or appearance. Every good designer loves the challenge of a limitation; what better to motivate you and spur you on to greater inventiveness?

But it's vitally important, when we look back at the animation design of any particular era, to remain aware at all times of the medium toward which the specific design was pitched. Designers always prefer to know the limitations and the dimensions of the medium for which they're



everything, from the design of the characters to the machinery of production, had to be tailored to the available budget. Each *Tom and Jerry* short had been approximately seven minutes in length, but even at the height of their production in the 1950s there were never more than ten released in any one year. By comparison the first season of *The Flintstones*, broadcast on ABC between September 1960 and April 1961, involved 28 separate episodes, each one running (allowing for commercial breaks) 24½ minutes. That's very nearly ten times the amount of animation screen time required annually for production of the *Tom and Jerrys*. Such were the time pressures of this new, more "industrial" pipeline that the difference in technique between television and feature production sometimes bordered on the comical, as Drew Gentle described:

My original job in the business, starting in '65, was as my father's assistant on shows like *The Herculoids* or *Bird Man*. We used to do these really long background pans, and my main job was rolling them with a paint roller.

It would nevertheless be an oversimplification to suggest that the question of production dollars-per-minute worked as an impediment to the creativity of either the background or the layout artists. Some animation-for-television looks cheap because it has to be produced cheaply. But not all of the design economies we perceive in these shows were born simply of the lower budgets that television production commanded. Some of them derive instead from the applied experience and visual ingenuity of seasoned designers, who knew very well that there was no point in rendering a compact image space visually confusing by choking it with elaborate designs, complicated by intricate and unnecessary detail.

Often we glimpse a television image, no matter how expensive or detailed, for only as long as we might glance at a traffic light or a speed sign, and the common ground between TV screens and road signs expanded further as TV picture editing became increasingly frenetic. The style spread to mainstream cinema, and eventually both TV and film editing felt the further impact, first of music video and then, as we shall see later, of video games.

In modern cinema, the human eye often has to cope with more than one kind of movement within the frame so the design of any background must be able to withstand the movement of the characters, the motion of the camera, and the momentum of the edit. As veteran story and layout artist Bill Frake points out:

It's a question of where you're going to look on the screen, because you only have two or three seconds to read an image. If you think of advertising, you look at something on a page in a magazine and that takes maybe one second. But a bus advertisement goes by really fast. How fast do you look at something as it's moving and how do you design something for that sense of speed and readability? Character animation is about timing, but layout design is also about timing, because the camera has to move, too.

Endnotes

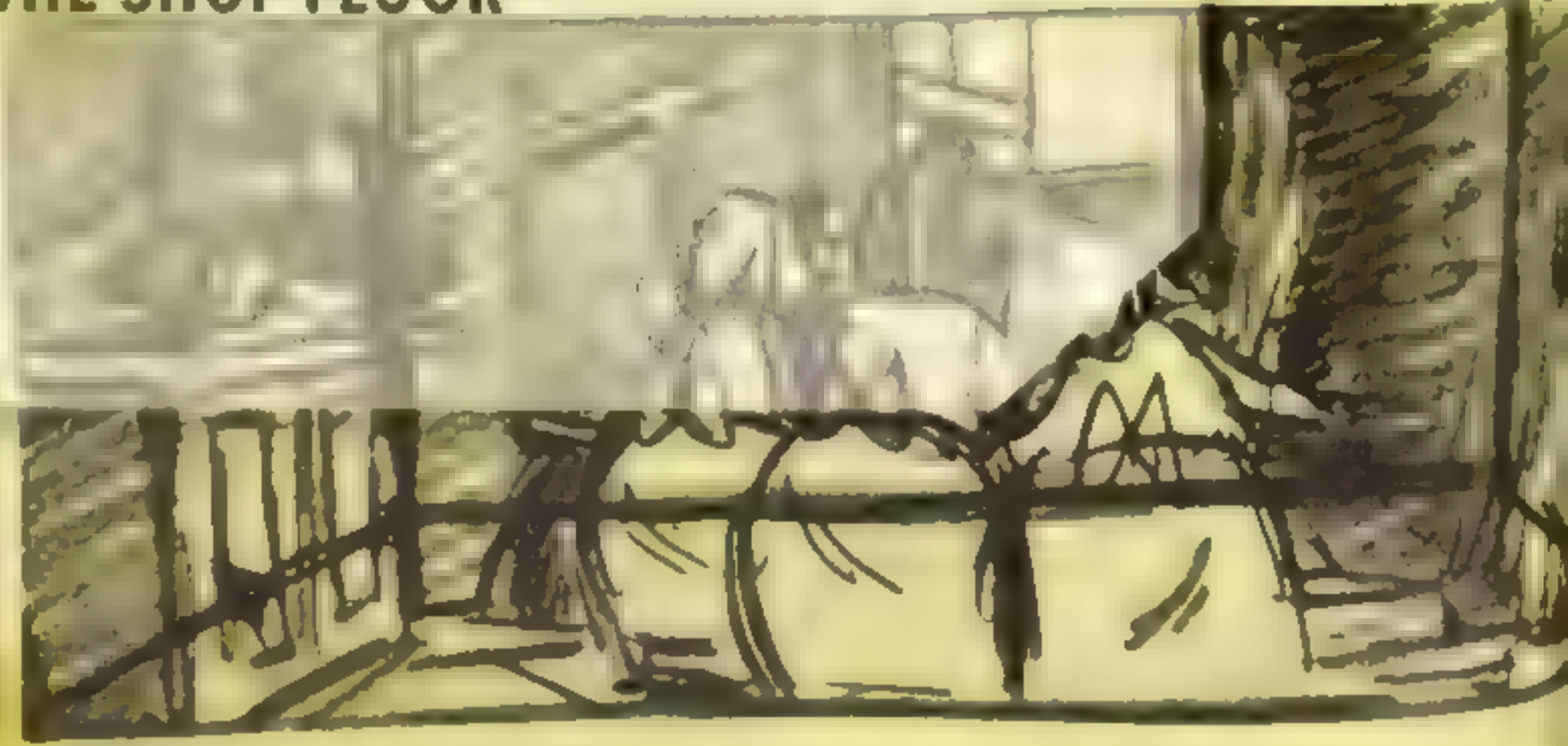
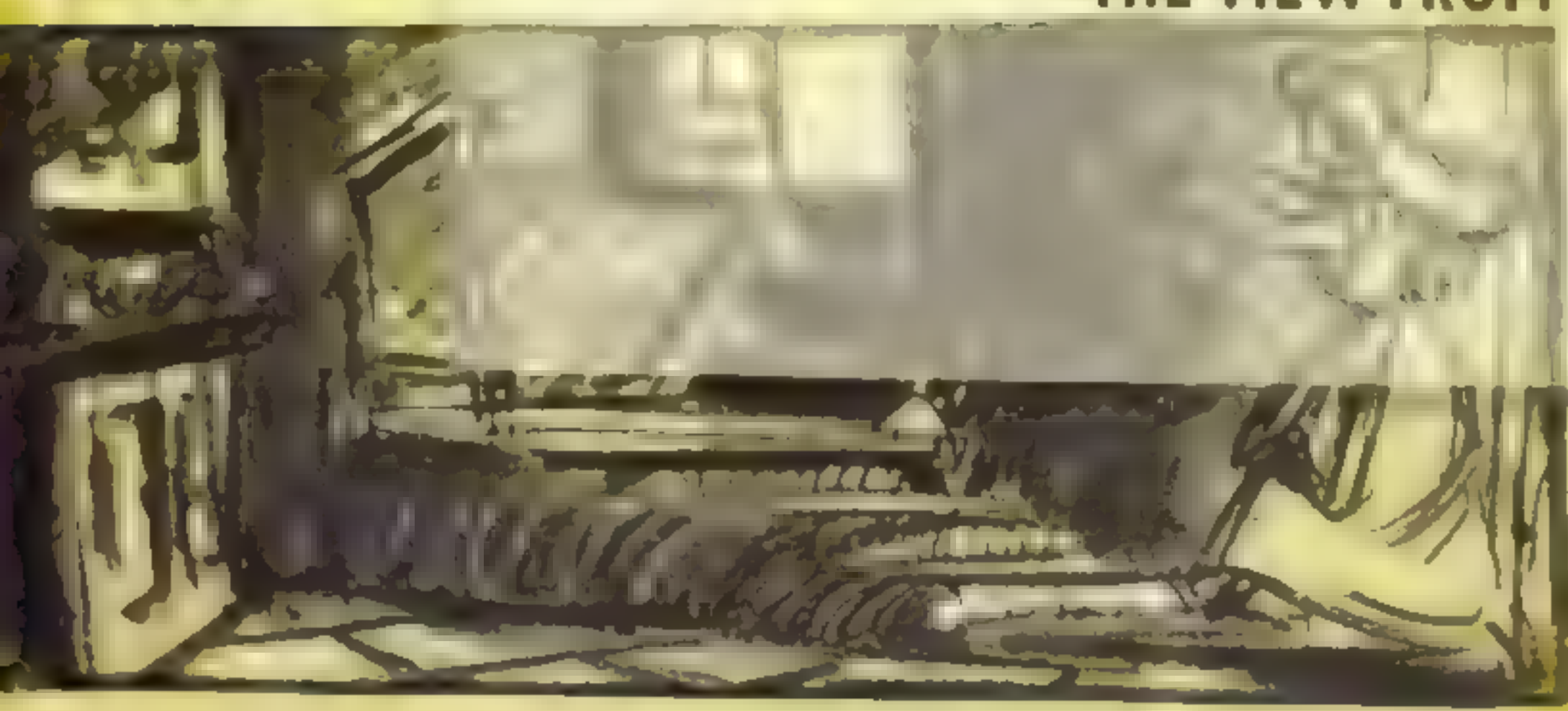
1. For a detailed history of Hugh Harman and Rudolph Ising's working partnership, see *Hollywood Cartoons: American Animation in Its Golden Age*, by Michael Barrier (Oxford University Press, 1999).
2. A. C. Nielsen survey, quoted in *TV Facts* by Cobbett Steinberg (Facts on File, 1985).
3. UK cinema information courtesy of Christopher Hitchens and Nigel Shore of Cinema Screen Installation & Maintenance.
4. For a full discussion of Disney's early and developing interest in television, see chapter ten of Neil Gabler's *Walt Disney: The Triumph of the American Imagination* (Random House, 2006).



**"I GUESS YOU
HAVE TO
DRAW THAT?"**



THE VIEW FROM THE SHOP FLOOR



As head of Layout at Hanna-Barbera in the 1980s, Charles Grosvenor not only had to bring all the trainees up to speed, but from time to time he also had to explain the animation production process to visiting professionals from other parts of the industry. One particular guest, who spent several days at the studio, and had a background in live-action cinematography, clearly found it hard to imagine working with actors who didn't really exist:

Because he knew nothing about the animation process it forced us to explain everything to him in very basic terms, and consequently reacquaint ourselves with some very basic concepts. On one occasion he came in and said, "So, after you do this basic shot, you might decide to go to the 'B' roll for a close-up?" and I said, "Well, if we drew a 'B' roll we could, you know?" And the guy said, "Oh, of course! You don't have these guys out there?! In live-action we can switch from a 35 to a 50mm lens or whatever, but I guess you have to draw that?" And I said, "Exactly!"

Whatever simplifications there might be in style or design, creating animation artwork for television certainly doesn't mean a reduction in either working hours or "pencil mileage." The artists do indeed "have to draw" (or paint) every component of the final on-screen image.

Audiences register the way animated characters move, and children and adults alike even copy their gestures. By comparison it's vitally important for the most part that audiences remain unaware, at the conscious level, of the movements made by the camera. Because the role of a good background layout is to frame the character's performance, not upstage it, it's understandable that students and audience alike should have remained unaware of the value and importance of the Layout Department's work.

With live-action set designers and directors of photography enjoying such high profiles, it's perhaps more difficult to understand why layout has never been widely perceived as a discipline to which students might aspire. There are a number of different migrations that commonly occur within or between the other animation disciplines.

When an assistant in the Character or Effects Department moves up to become an animator, the inbetweeners routinely take their places, while background painters may wind up moving into art direction and story artists often progress to directing. But Layout has never been widely perceived as a department to which artists feel they might graduate.

It was interesting therefore to meet and talk with James Lopez, who, after many years working as a character animator, found himself taking on the challenge of a move into layout work at the Disney feature studio in Burbank. By his own admission, the seeds may have been sown early on:

On my second job in the animation business I was an animator on *Rover Dangerfield*, but they didn't have any room in the section where all the animators were sitting; the only desk they had left for me was right in the middle of Layout. So from time to time I'd get up from my desk and mosey around and see what the Layout guys were up to; I'd always wonder, "What are all these numbers: '5 thousand N/S, 48/50 E/W'?" And that's when I

started to learn about camera mechanics. So, in a weird way, I kind of grew up in Layout.

Spending time in the Layout Department so early in his career not only gave James Lopez a perspective that few other character animators at that time could share, but has influenced his approach to the entire process ever since:

I really learned a true appreciation for layout and I realized it's just as important as character animation, if not more so. The responsibility is greater. You're setting up and planning everything that's going to happen all the way down the line, and if you fall short at that point, then things just fall short throughout the production. Layout is probably the most essential department and yet it's often the most underappreciated.

Not all character animators, however, are afforded a similar insight into the workings of the Layout team so, prompted by various rumors I had heard and practices I had witnessed during my own time in the industry, I asked Drew Gentle if, when character layouts were passed on to the Animation Department back in the early days of TV animation, the animators had ever simply rolled them up and thrown them away. His response was immediate and frank:

Yeah! Quite frequently. And there were two different reasons: one was because the animator could draw better, could do a better pose, and the other reason was because they couldn't draw as well as the layout artist. One or the other.

The Background people resented Layout too because all the problems that they had to deal with came from the Layout Department. So they actually saw Layout as being adversarial:

PREVIOUS: This Workbook page from Disney's *Sleeping Beauty* demonstrates how, in hand-drawn animation, every decision about framing the performances, moving the camera, and choosing the edit points has to be made long before even the first rough pass at character animation is photographed.

Story sketches and framing (or "Fielding") diagrams by
Disney Studio Artist
Sleeping Beauty (1959)
Supervising director: Clyde Geronimi

"Why don't they understand what we need?"

Both departments pull in different directions and, especially working in TV, we were under incredible deadlines.

We had to fix any problems with the storyboard in layout so we would complain about storyboards, whereas the Background Department and the Animation [Department] would all complain about Layout! And I'm sure the animation checkers would complain about the animators.

I learned a lot from Don Morgan, who was the head of layout most of that time. He was a wonderful teacher. It was mainly that you're staging the whole show, that, doing layout, you are the pivot upon which a cartoon is made.

THE PURSE STRINGS OF THE PRODUCTION

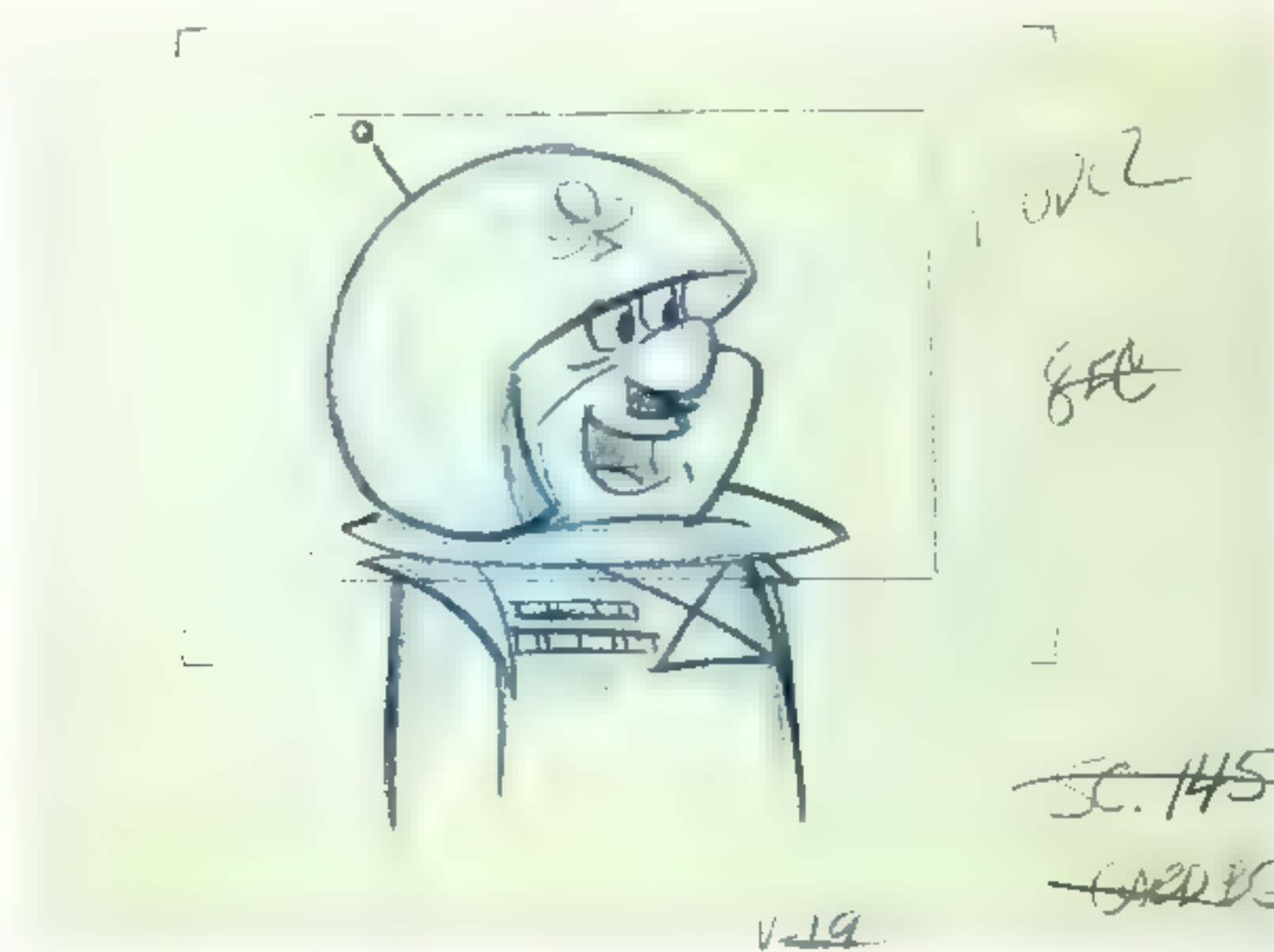
Aside from the movement of the characters and the camera the most important consideration on any production is, of course, the movement of the money, without which everything very quickly grinds to a halt. Bill Perkins had the good fortune, early in his career, to have Disney layout legend Ken O'Connor as his mentor:

Ken said a lot of really insightful things about layout, but one particular comment he made is so dramatically useful that I keep it in my head all the time. He said, "The Layout Department holds the purse strings of a production." That one sentence, to me, said it all. You can design a very ambitious scene with twenty characters, or you can draw it simply.

It's in the Layout Department, more than at any other stop along the way, that the cost implications of every creative decision on a production can best be monitored. When you decide how large or small

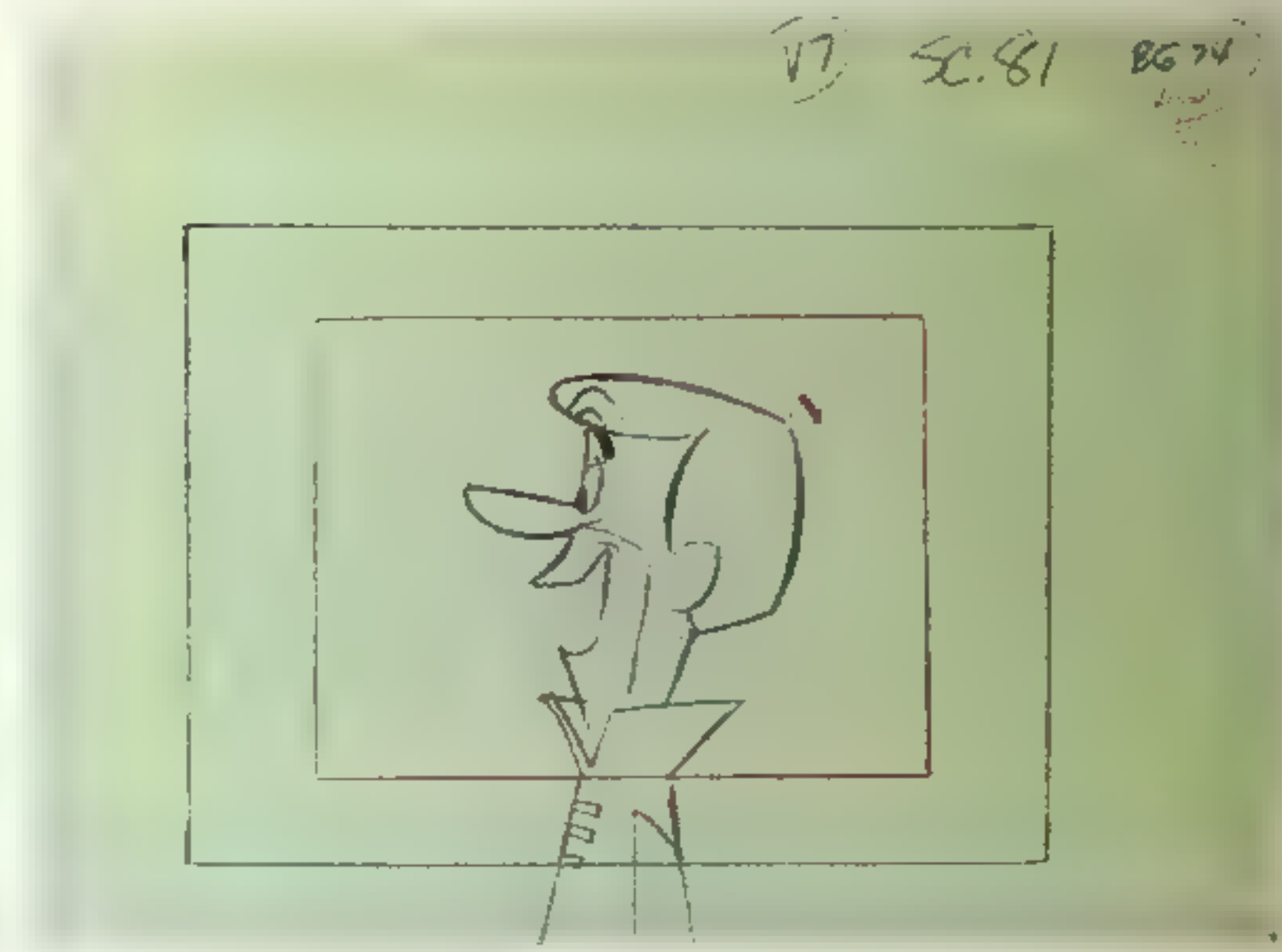
TOPFOUR: Four different rough character layout sketches from Season One of *The Jetsons* with fielding diagrams indicating the required "TV Safe" framing for 1960s television aspect ratio, which ensured that all essential action and detail could be seen—even on those domestic TV sets that "cropped" the broadcast image most severely.

The Jetsons Season One (1963)
Hanna-Barbera Studios



BOTTOM: Just as animators need to keep the proportions of a character's facial features constant from one scene to the next (within the broader geometry of the head), so the layout artist has to have access to the same detailed model sheet information on each character, in order to make sure that the relative sizes and complementary shapes work within the composition of the frame.

Model sheet for George Jetson (artist unknown)
The Jetsons Season One (1963)
Hanna-Barbera Studios



the screen. Three pointers might be of value here ...

- (1) Vertical set-ups (90° tilt fields) should always call for a counterclockwise (CCW) rotation of the camera. Due to the way in which the animation camera is built, a 90° clockwise rotation is very difficult. Layout artists should understand that to simulate a counterclockwise tilt of the camera they should rotate their animation disc clockwise. For example, once a piece of pan paper has been properly positioned (on top pegs) on the disc, the artist would rotate his/her disc clockwise to view the set-up in its proper visual orientation. The peg holes in a vertical set-up should always be to the right.
- (2) A common error in fielding arises in tilt field scenes. Figure 37 is a maximum tilt field guide. For example, a 10F can be, at most, tilted 9° clockwise or counterclockwise, an 8F 25°. Note, however, that these

Figure 35: A grid chart to determine field guide shifts.

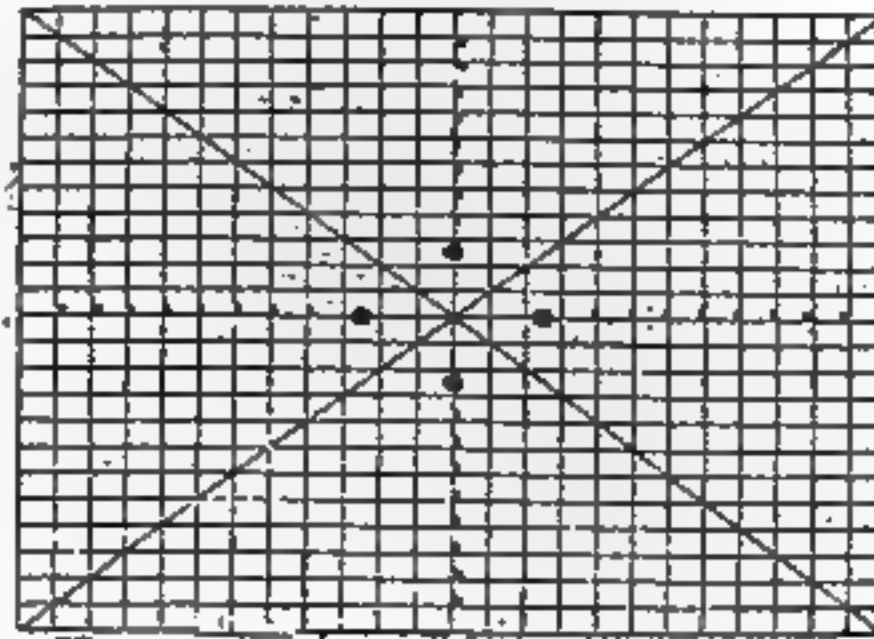


Figure 36: A tilt field background, in this case, a pan.

are maximums. An 8F does not always have to be tilted at 25°. Often, layout artists will design a set-up for 10F at a 9° tilt and later re-use the set-up at an 8F 25° tilt. That is impossible. The verticals in a tilt field BG are fixed and obviously cannot be accurate for both, in this case, 9° and 25°. Here an 8F should also be tilted at 9°. Layout artists should be aware of proper techniques of fielding tilt set-ups. The guide illustrated in Figure 38 (a protractor) can be very useful in this regard. This device is more versatile than the maximum tilt guide, and it can be used to check any tilt set-ups.

- (3) Again, it should be emphasized that tilt fields should be plainly marked on the BG to assist the painter.

--- PAN BACKGROUNDS. The mechanics of the pan BG is another area that Layout should thoroughly understand.

To facilitate their movement through the camera platen, pan BGs are usually put on top pegs. This allows the camera operator to change the cels of animation (which are on bottom pegs) and shift the position of a BG independently. In some cases, however, it is necessary for pan BGs to shift to the bottom pegs. For example, if a character is seated in the A section of a pan BG and the camera pans to another seated figure at the C position, the BG should shift to bottom pegs. It is extremely difficult for camera operators to match pans of top and bottom pegs exactly, and as a result the seated figures

HELD CELLS. Held cells are objects or props which will animate in a later scene, but for whatever reason are still in the scene in which they are "held". Also, to maintain a consistent "look" certain props --- such as cars --- are invariably held cells. Held cells are xeroxed onto cels and painted by the Ink-and-Paint Department, NOT the BG Department. They should be properly separated as necessary, and they should be cleanly drawn --- with NO shading. Held cells are really the only pieces of artwork created in Layout that eventually make it to the screen without other artists working over them.

SAME AS SCENES. "Same as" (S.A.) or "works out of" (W/O) scenes are those scenes based on previous material. Since there are usually more animators working on a picture than layout artists, it is quite possible that different animators will get S.A. or W/O scenes to animate. Therefore, it is necessary for layout artists to xerox ANY re-used animation (not BG) material and place it in the scene folder.

CUTTING IN. Many times it is possible, simply by using a smaller field, to re-use animation for subsequent scenes. (See Figure 27) While this practice is certainly economical it has its limitations. In Figure 28 the two situations illustrate incorrect uses of cutting in, and their more proper solutions. Certainly layout artists should use the concept of cutting in --- but with care.

REGISTRATION. In terms of registration, animators need a clean red line marked "REG TO BG" to properly register their animation to backgrounds, as in Figure 22.

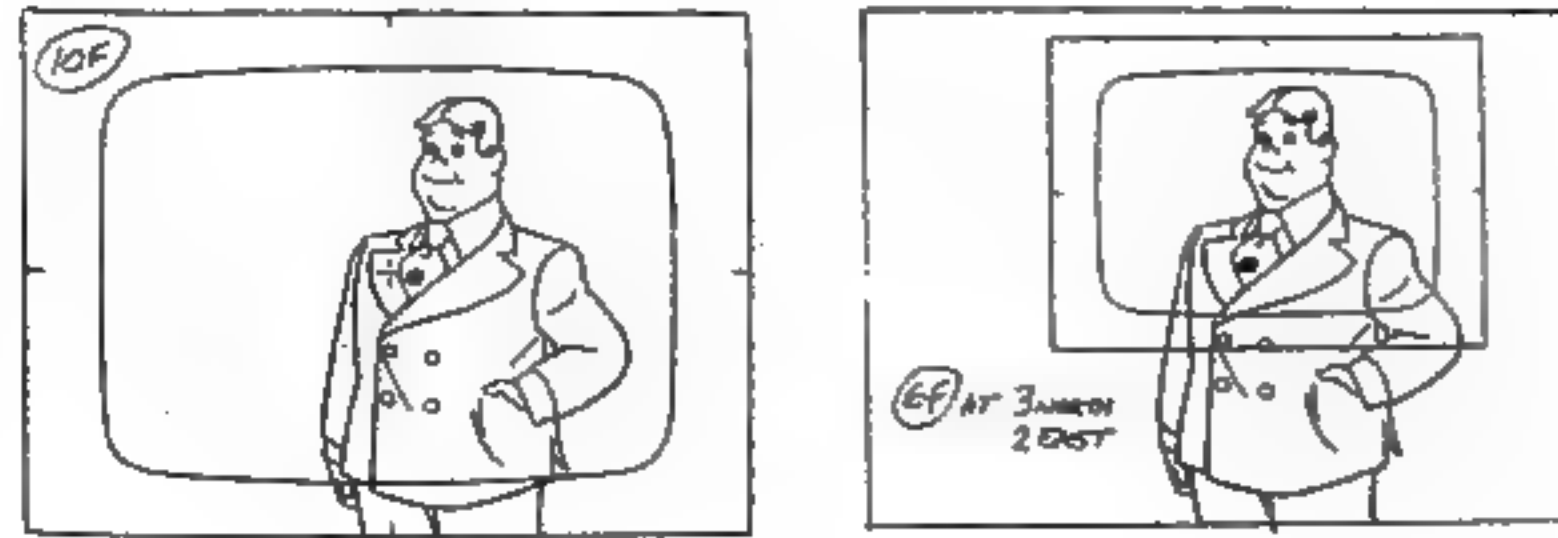


Figure 27: An example of acceptable "cutting in".

the figures should be drawn out beyond the 9F academy line while the BG should be drawn out at least to the 12F academy line.)

With the field guide frame in mind, composing the layout should begin. It is difficult to list out hard and fast rules of composition --- composing a pleasing image is an art, and different artists can find different, workable solutions to the same problem. However, there are some basic concepts that can assist the layout artist, and some of these may be found in Appendix I.

One of the basic illusions of animation, as well as of any representational painting or drawing, is one of depth. Film presents a two dimensional image that gives the illusion of a third. Artists can go a long way towards creating this illusion believably by designing layouts with depth in mind. Often, there is too little effort spent on getting convincing depth into layouts. Figure 16 is typical. Two characters, centered in an interior setting, play their action out against a wall that is parallel to the picture plane. The result is extremely flat. In Figure 17 one solution to the problem is suggested. The characters have been moved slightly off center, and the wall behind them has been angled: immediately there is a greater sense of depth. From these bare bones of a layout props can be added to make the interior any sort of room --- in the case of Figure 18, a warehouse. The placement of props, besides defining the environment in which the action takes place, helps to accentuate the action. Meanwhile, the action itself is kept legible by being played against a clear spot on the BG. The gestures of the character on the left in Figure 18 should read clearly in this situation.

Set-ups that help break down the illusion of depth should be avoided. Tangents destroy depth in drawings, as illustrated

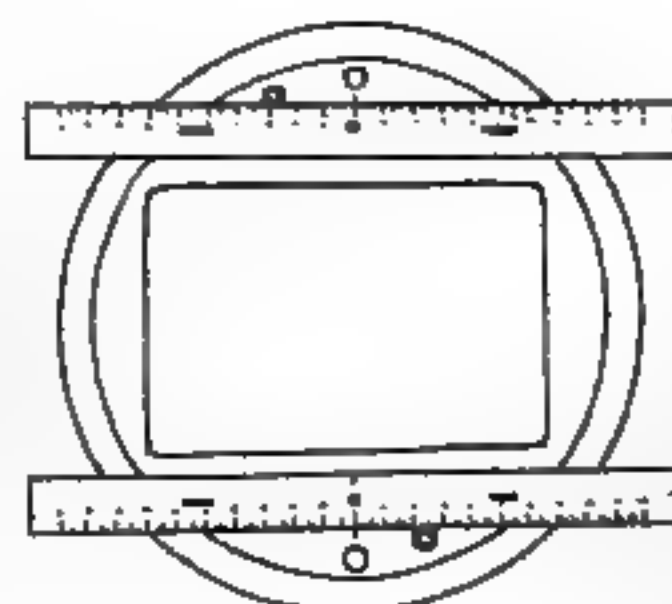


Figure 14: An animation disc

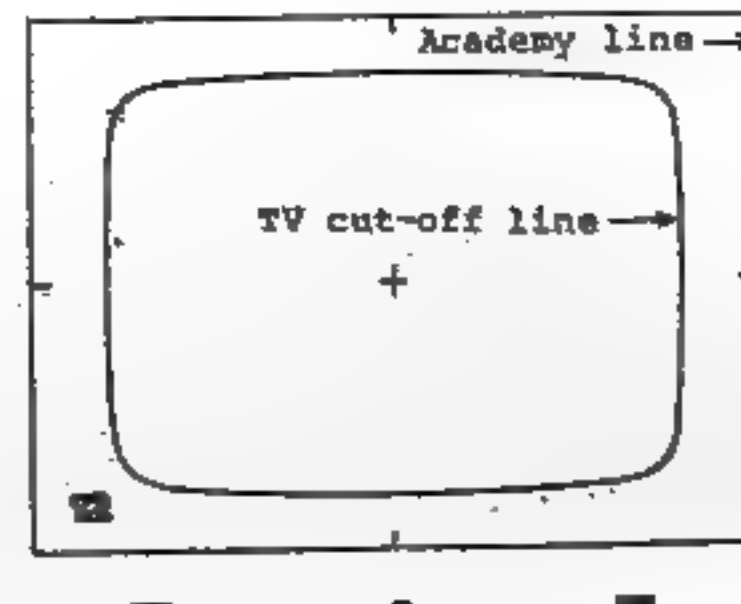


Figure 15: A field guide

As Charles Grosvenor recalls, "In the fall of '83, after a season of being the department head and realizing that a lot of people didn't really know what was going on, I decided to put the manual together. And it was surprising, there are a lot of things in there that are very very fundamental, very basic, but people just weren't aware of them. There were only 40 or 50 copies of the thing made, but it made the rounds. Years later somebody called me and said, 'I was in Spain and saw the Hanna-Barbera layout manual ...' How did that get to Spain ... ?!"

Five pages with diagrams from Charles Grosvenor's (much copied) in-house layout manual, Hanna-Barbera Studios (1983)

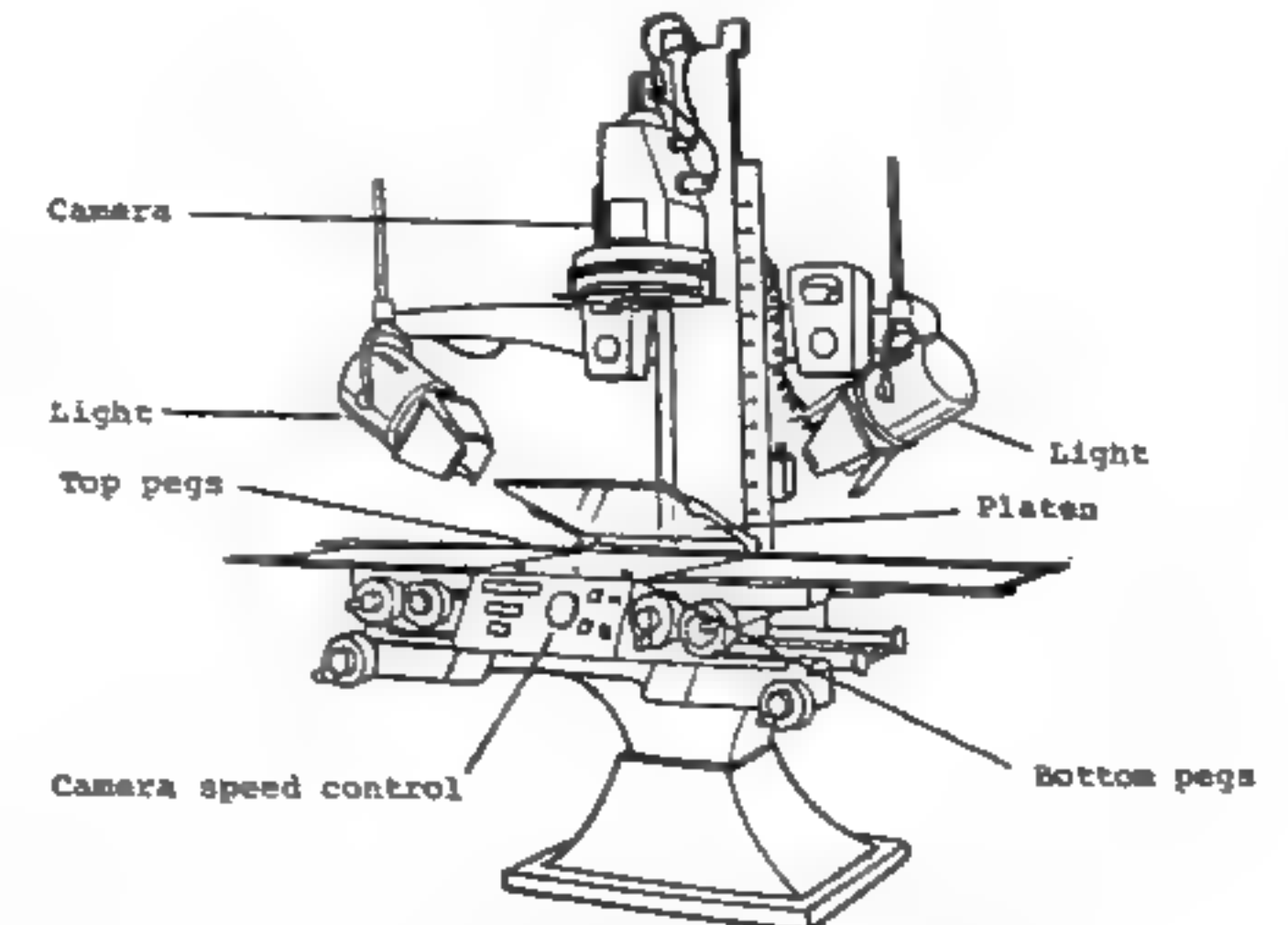


Figure 33: A generalized diagram of an H-B animation camera

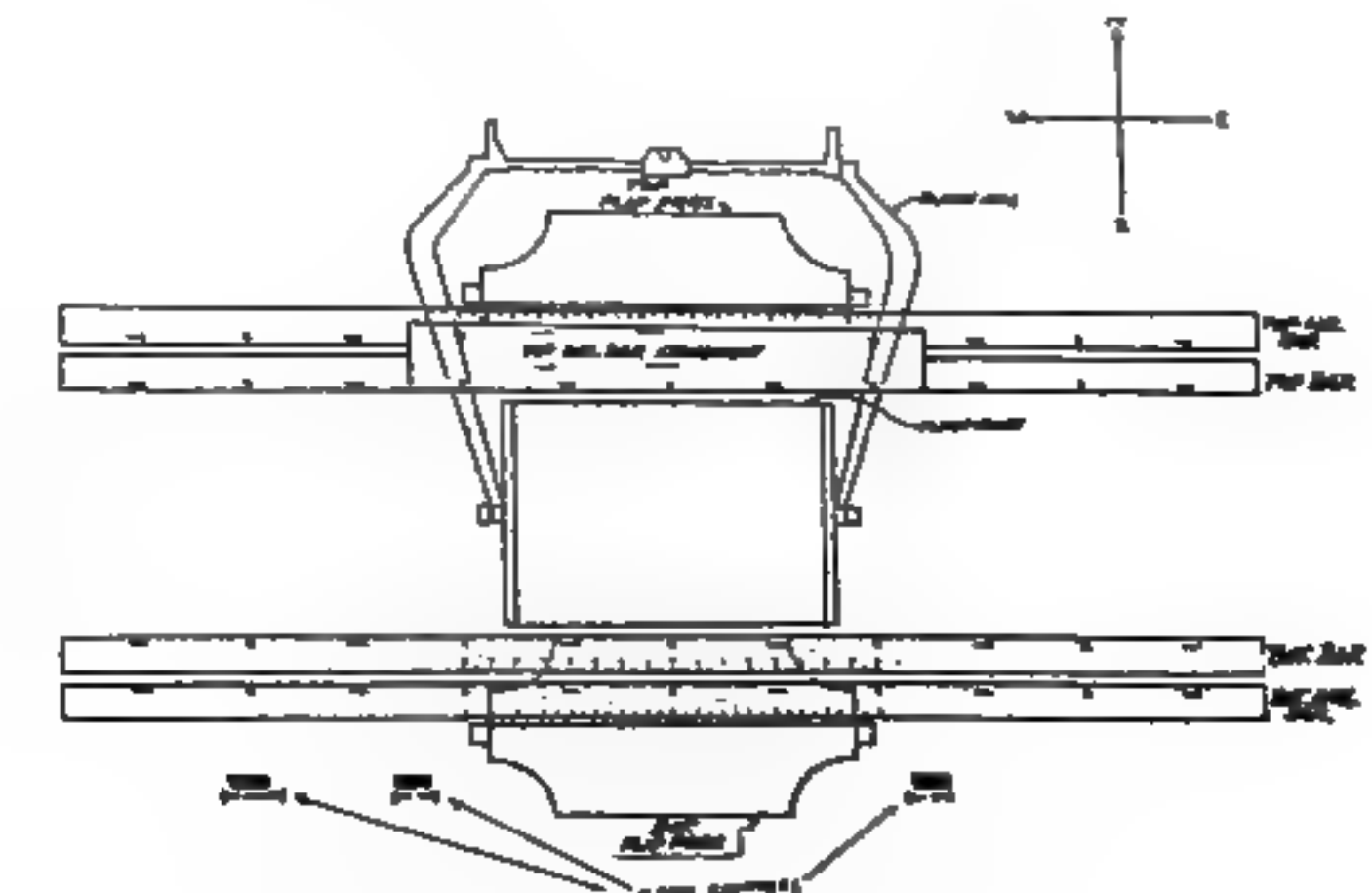


Figure 34: The camera table.

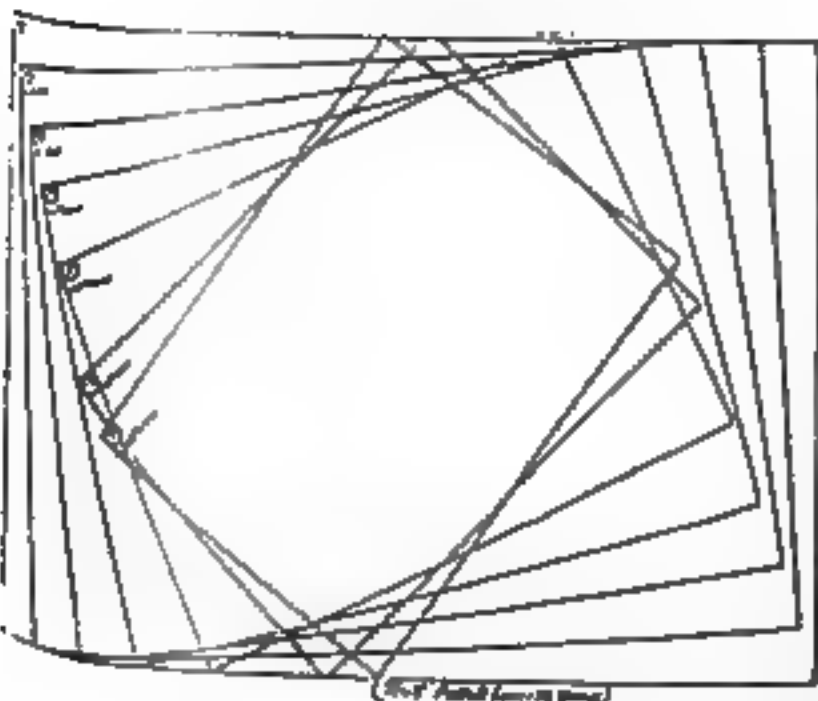


Figure 37: A maximum tilt field guide

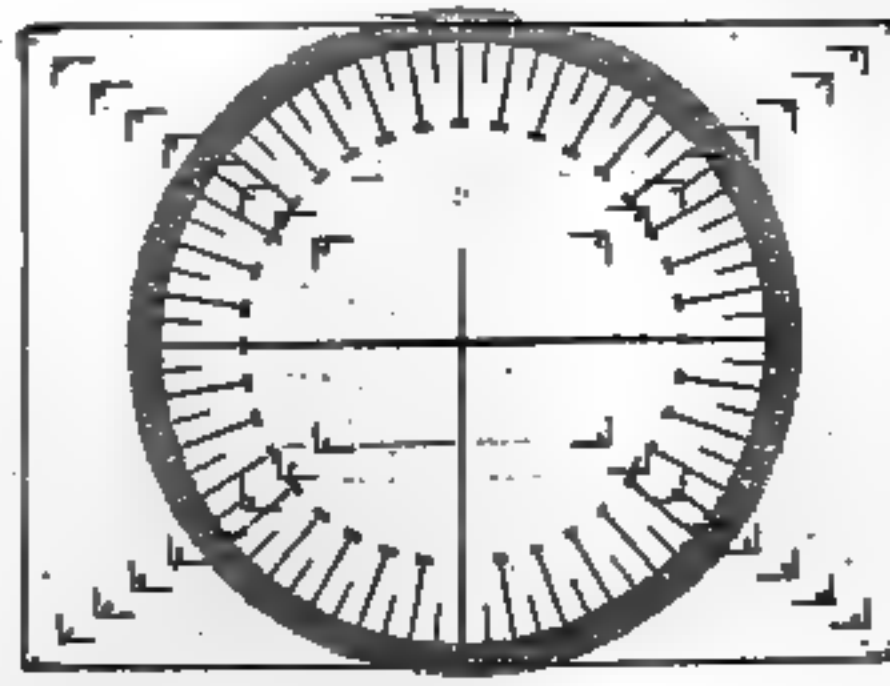


Figure 38: A protractor

a character has to be in the frame, you dictate the size of the actual drawings on the page: any setup that requires the artists to work on outside sheets of paper will mean the scene takes longer to pass through the animation and clean-up departments; position important action in the distance and either regular drawings have to be resized or tiny line artwork has to be created, with the risk of errors being magnified in the final image.

Depending on how much money is available for the scene in question, the layout artists also have to think in terms of possible complexity: How many vehicles will there be on our street? Would it be less work to suggest staging a traffic jam so that fewer cars need to move? Are there any other performing characters or can the figures be stationary? Is there brickwork on the walls or can the rendering be plain?

Having experienced budget restraints in both feature and TV work, Brad Bird has come to view storyboarding and layout almost as two sides of this same economizing process:

My way of viewing it is a little different from most animation training. I believe in layout; I think it's a very important part of the process. It's the language of film and it's the language of art-directing sets, and I am not somebody who delays that part of the process till later. But a lot of what people would traditionally call "layout," I already have a pretty accurate blueprint of in storyboarding. 'Boards are much more like a first shot at laying out the scene for two reasons: one, because my brain works that way. I don't think of shots as separate; I don't think, "Here's the idea and we'll stage it later"; a lot of times I think about it staged.

And the second reason is defensive: I always felt like I would spend more money on the 'boarding process so that when we got to film we knew

exactly what we were doing and could move much more quickly and efficiently.

STORYBOARDING

In the earliest stages of its development, an animation script usually consists of words written on a page and rough sketches scribbled on paper. Just as the writers need to read the dialogue and directions in loud enough voices for the whole room to hear, the story artists have to produce sketches that are bold and legible enough to be seen from the other side of the room. If those sketches are put directly onto a pin board mounted on the wall rather than shuffled around on the tabletop, the development of a scene's visual and cinematic possibilities can immediately be assessed and digested by everybody in the room.

In the period before all these separate story beats and character moments settle into a linear, cause-and-effect narrative that can be shaped into the coherent grid of a finished storyboard, each of these rough drawings is referred to as a *story sketch*. The term also applies anytime an individual panel or group of drawings is singled out from the 'board to be altered or scanned.

Even the most generic stick-figure diagrams can provide a viable departure point for a storyboard, but it's important to have a clear indication of the essential design language of the movie from as early a point in the preproduction as possible. Unless the story artists know the relative heights, shapes, and sizes of the principal characters in advance, positioning them within the frame, even as rough outlines, will be a gamble at best. Furthermore, the story artists have to know from the outset which aspect ratio the movie is going to be filmed in. Next to *The Incredibles*, for example, *Dumbo* looks very nearly square. No sequence, whether it's a chase or a romantic interlude, can be successfully staged in the same way within two



106 Mr. Incredible's arrival in the bank, moments before he intercepts Bomb Voyage.

Lighting thumbnail by Lou Romano

The Incredibles (2004)

Directed by Brad Bird



107 Story sketch indicating both color and lighting for a nocturnal scene where Timothy leads Dumbo into one of the circus tents.

Pastel by Disney Studio Artist

Dumbo (1941)

Directed by Ben Sharpsteen



FOLLOWINGSPREAD In the words of Drew Gentle, "Give me an Alex Lovy board any day! Alex was in the top 5 people at Hanna-Barbera 'cause he was so talented, so prolific and such a seasoned guy. I don't know much about his background before he got to Hanna-Barbera, but he was in his 50s when I was in my 20s and he would do a whole storyboard for a 10-minute film in an evening! And they were very rough short-hand, but they had all the information you needed."

Original storyboard panels by Alex Lovy

Episode 8, "Batty Bear" *The Yogi Bear Show* Season Three (1961)

Produced and directed by William Hanna and Joseph Barbera

C-31



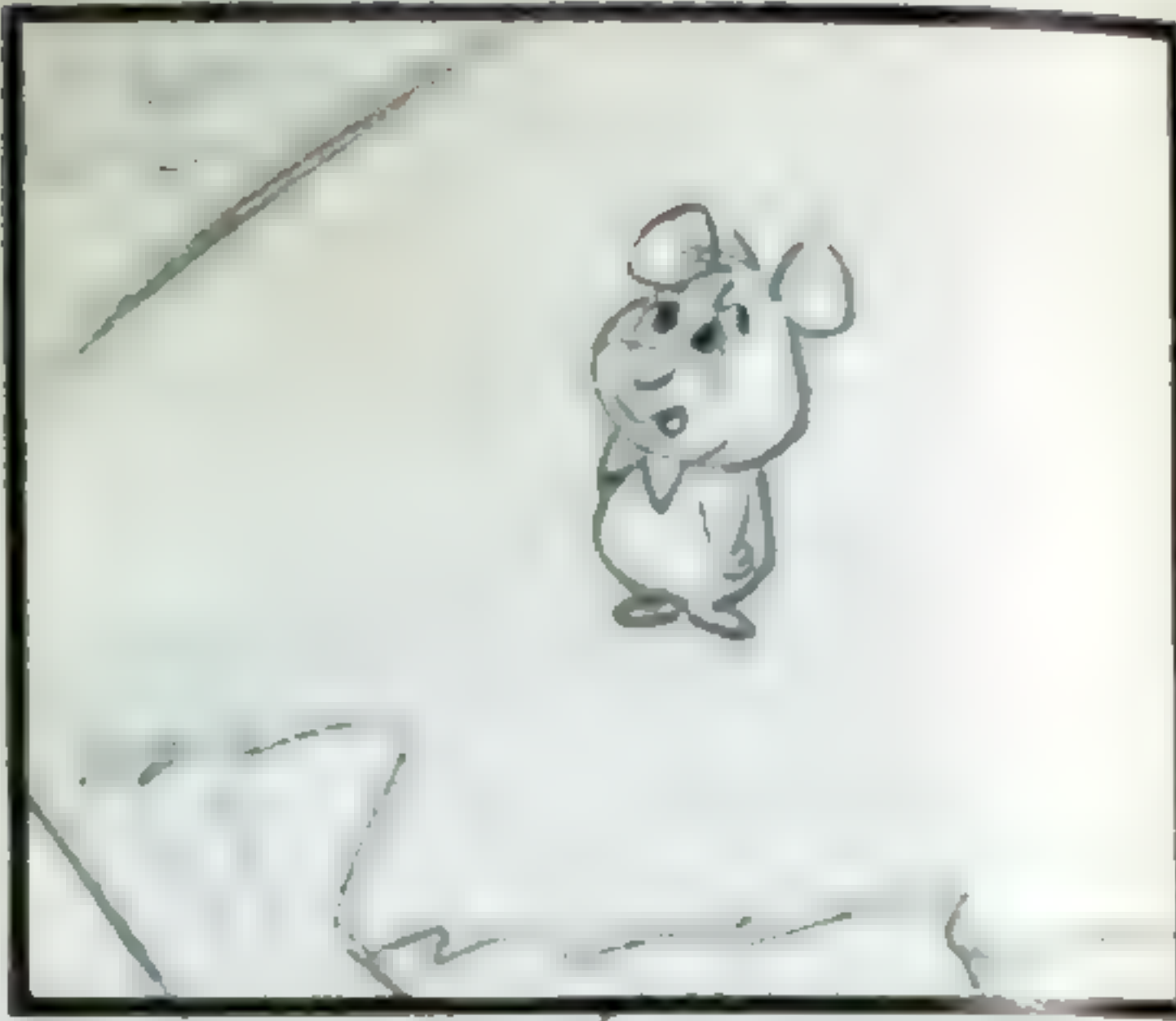
YOGI: JUST LIKE A SAIL-PLANE,
ZOO-BIO!

56



YOGI: PIC-NIK TIME... HERE
I GO! --!

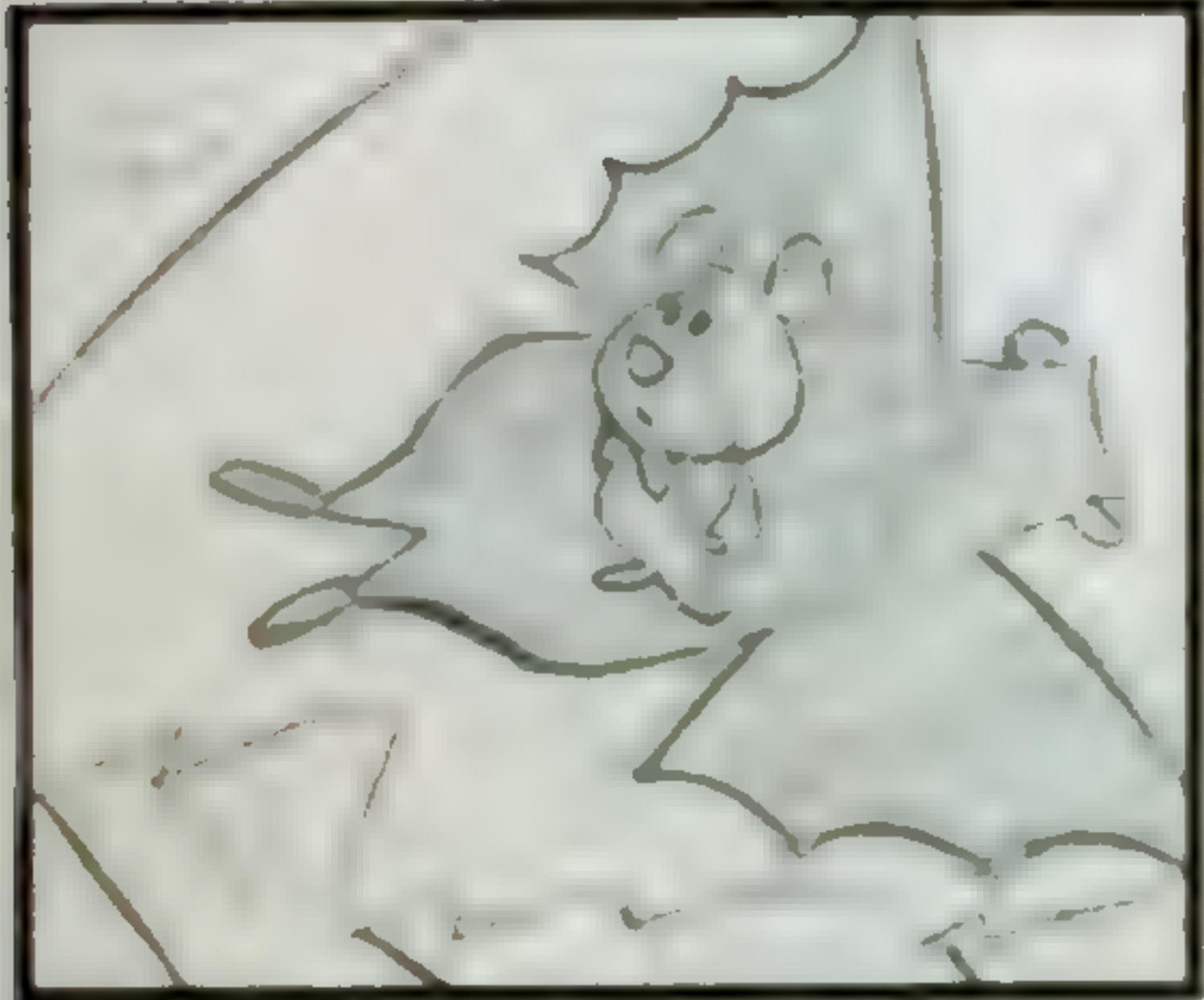
C-32



ZOO-BIO: I DON'T LIKE IT,
COME ON DOWN!

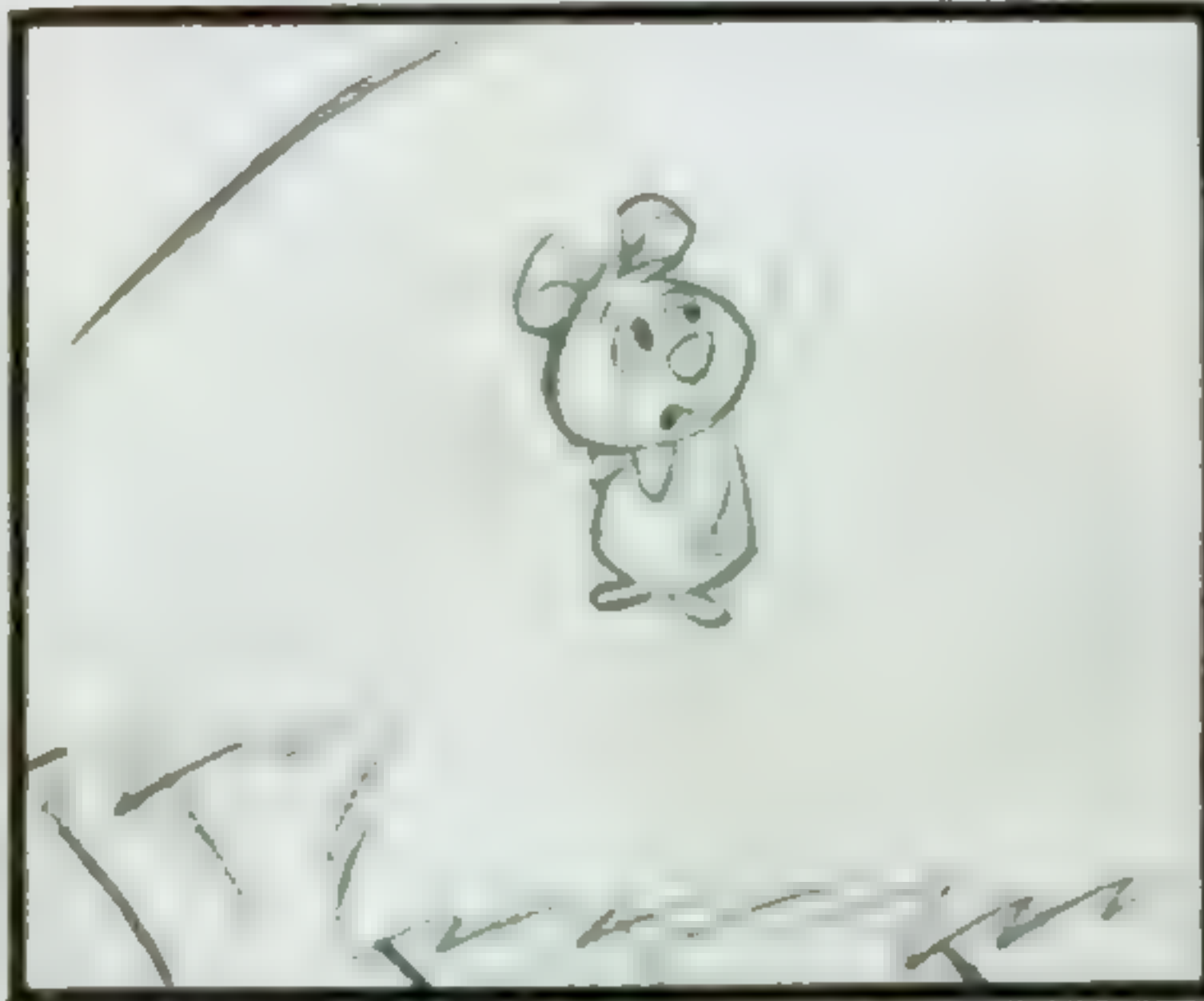
57

5. THE SAIL-PLANE... →



ZOO-BIO: THE BATTY BEAR MOVES
... HEY-HEY-HEY!

59



ZOO-BIO: "BATTY BEAR" IS RIGHT!

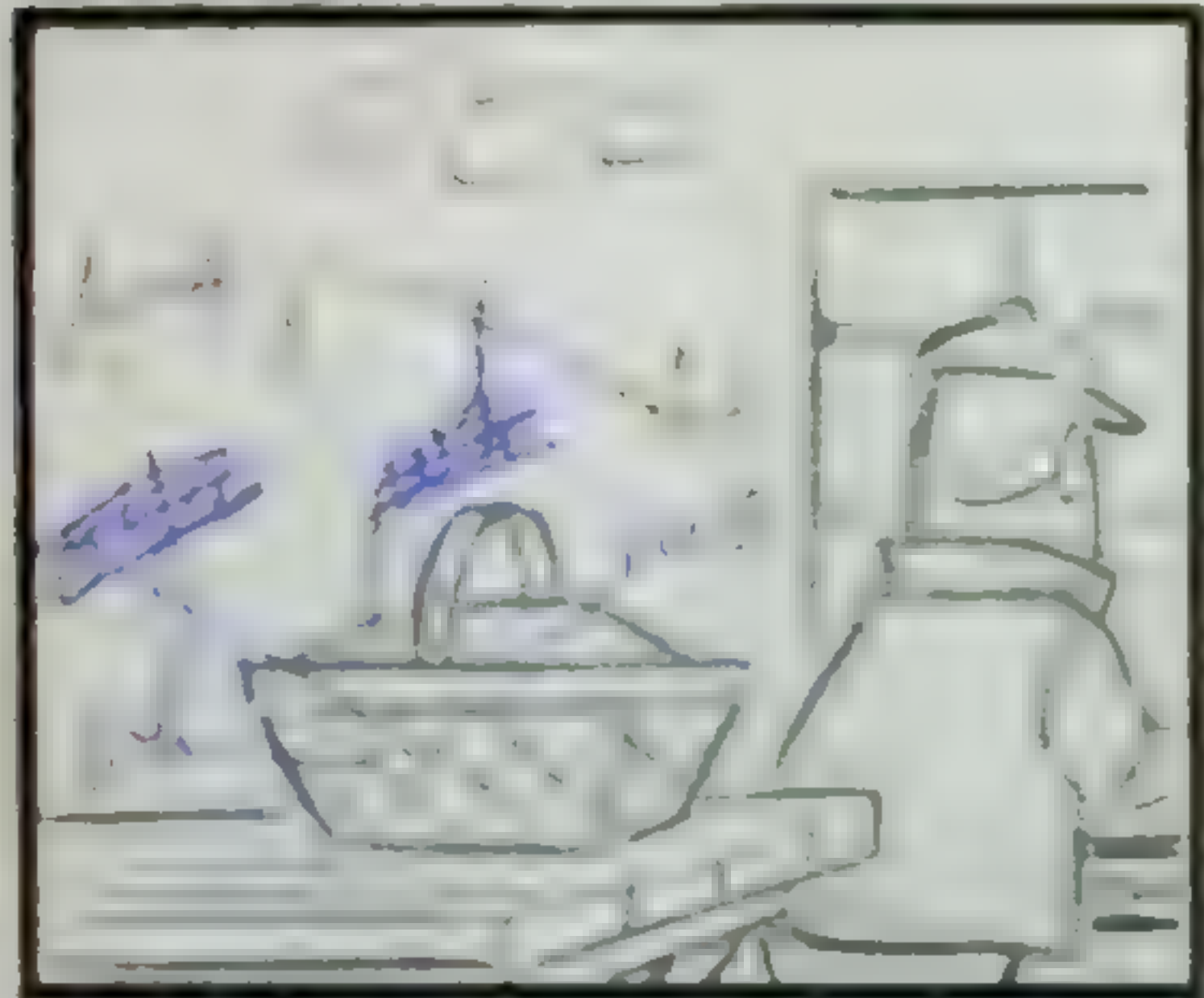
60

C-33



YOGI: LUNCH AT TWELVE O'CLOCK
MOVING IN ON OBJECTIVE... PIC-NIK
BASKET!

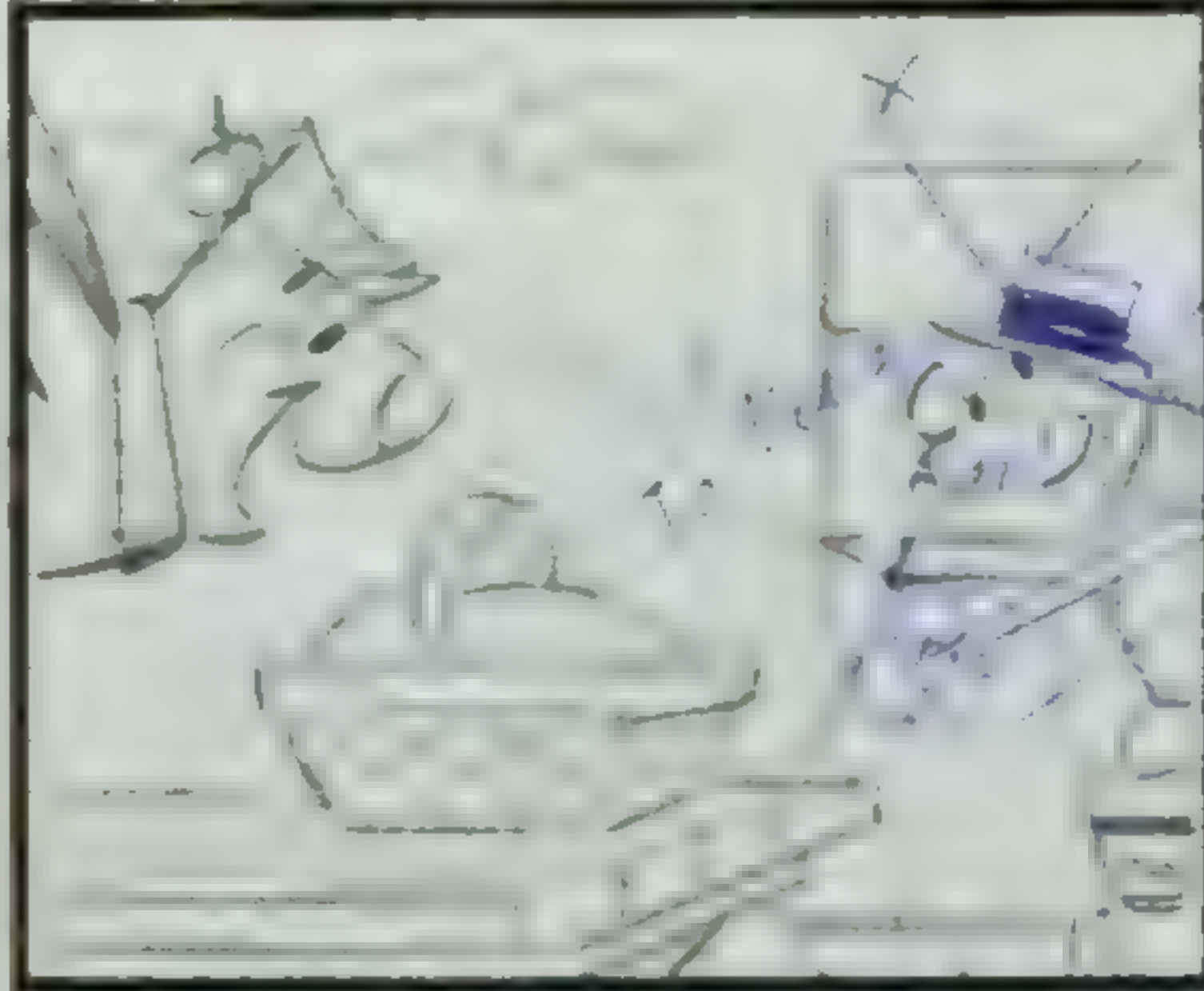
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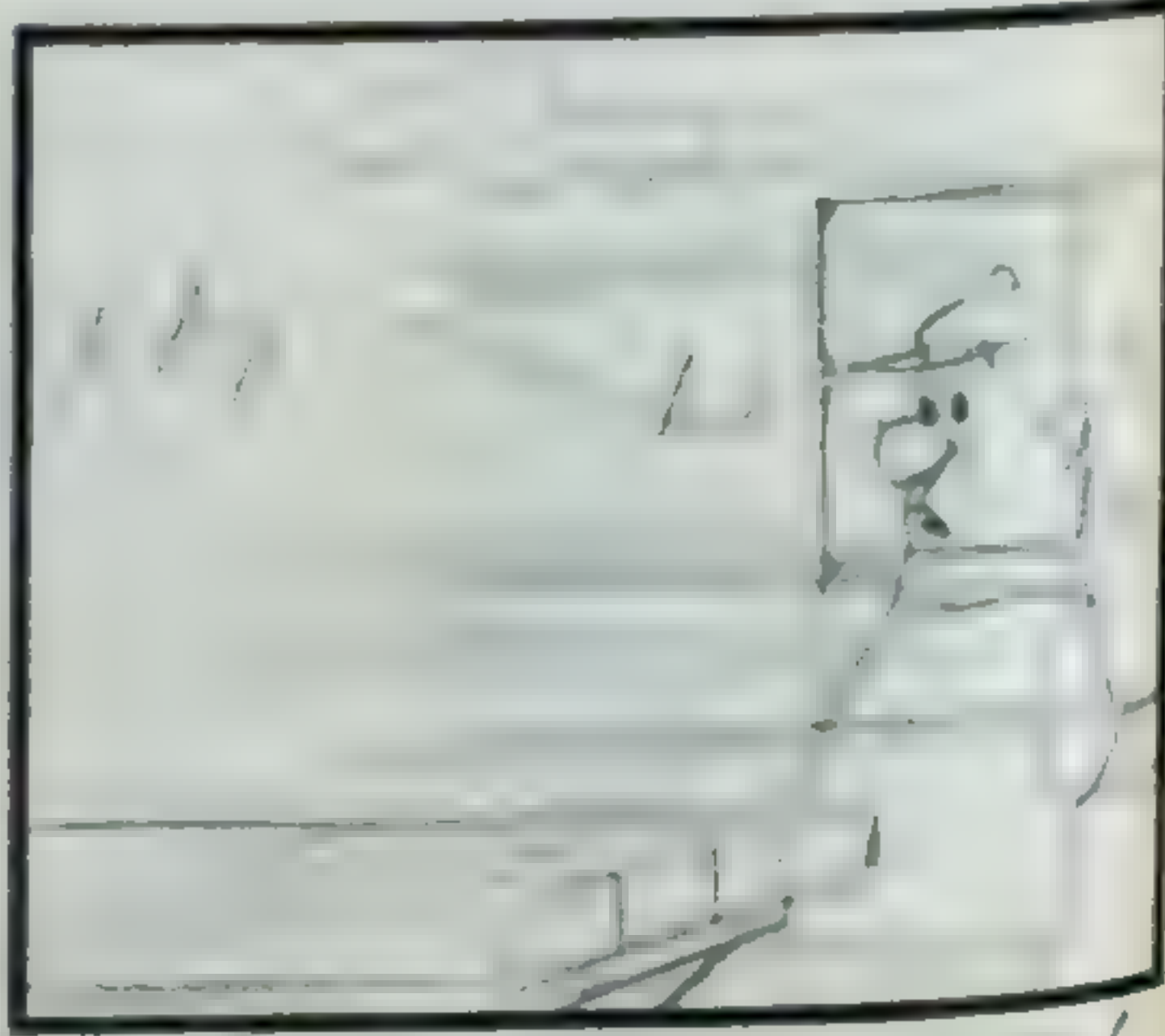
FX: PLANE IN DIVE

YOGI
THRU
→

62



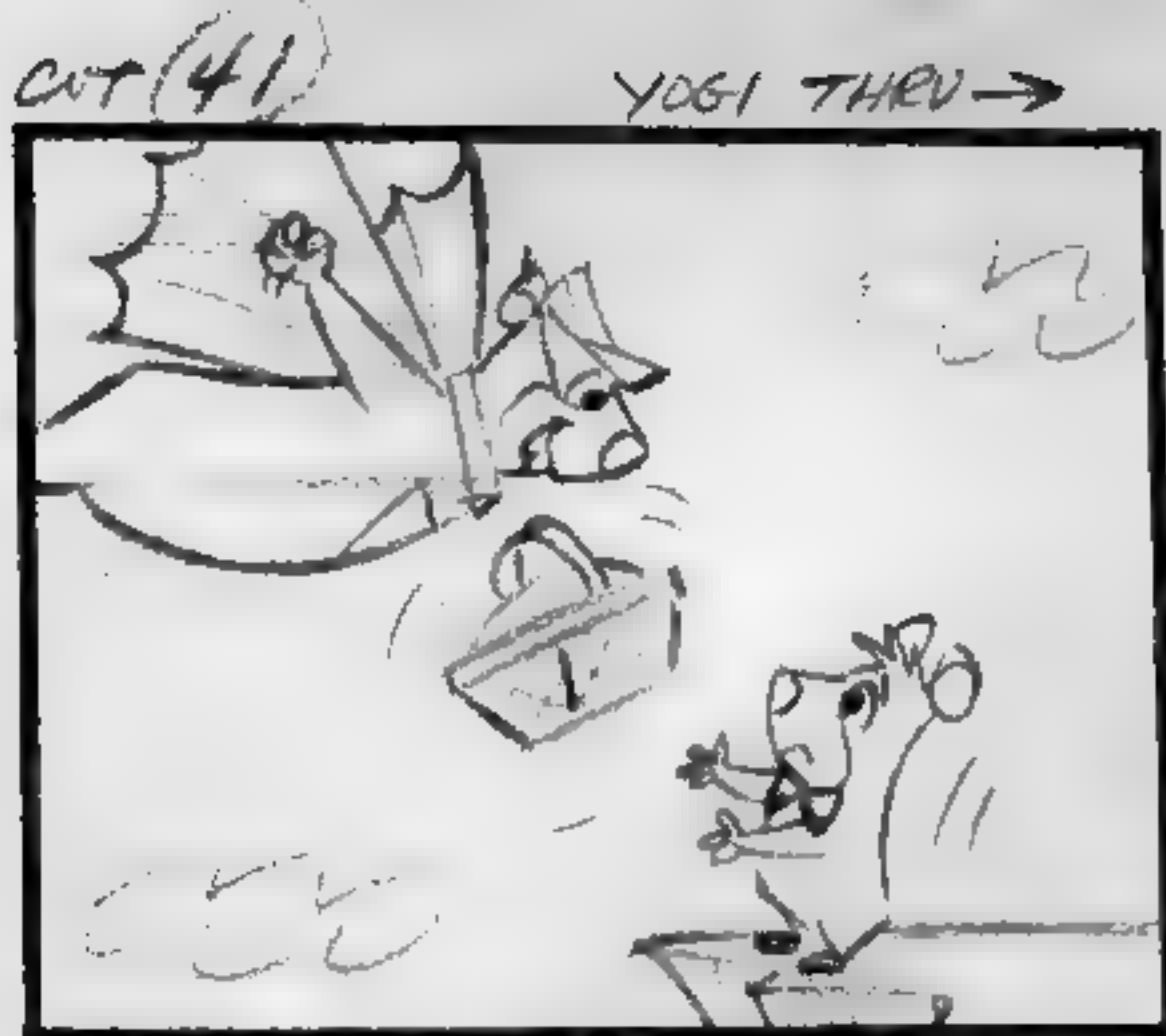
63
OK



FX: ZOOM



RANGER: A FLYING BEAR -- HA-HA-HA -- THAT'S A HOT ONE!



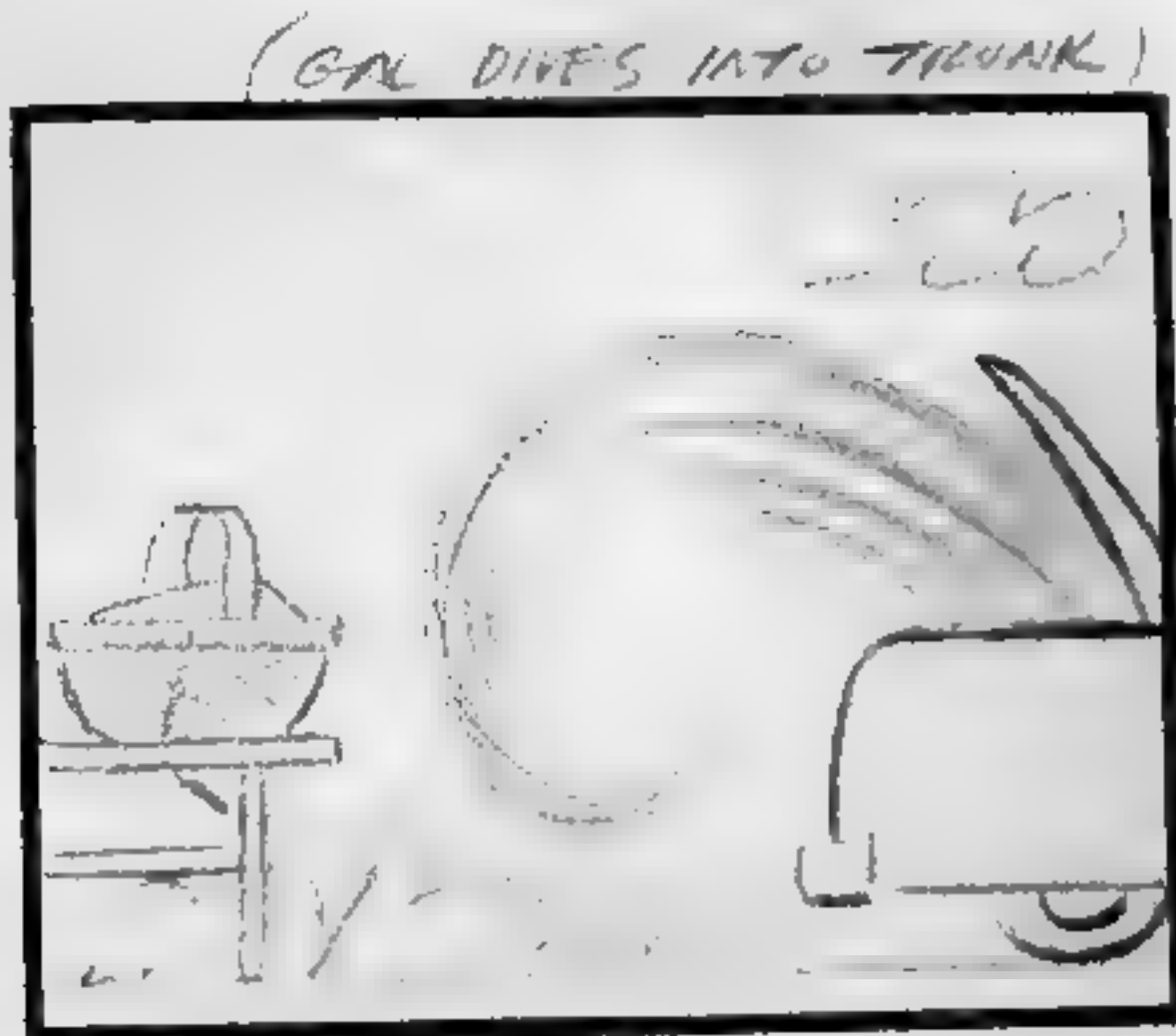
YOGI: HERE, BOO-BOO -- CATCH!



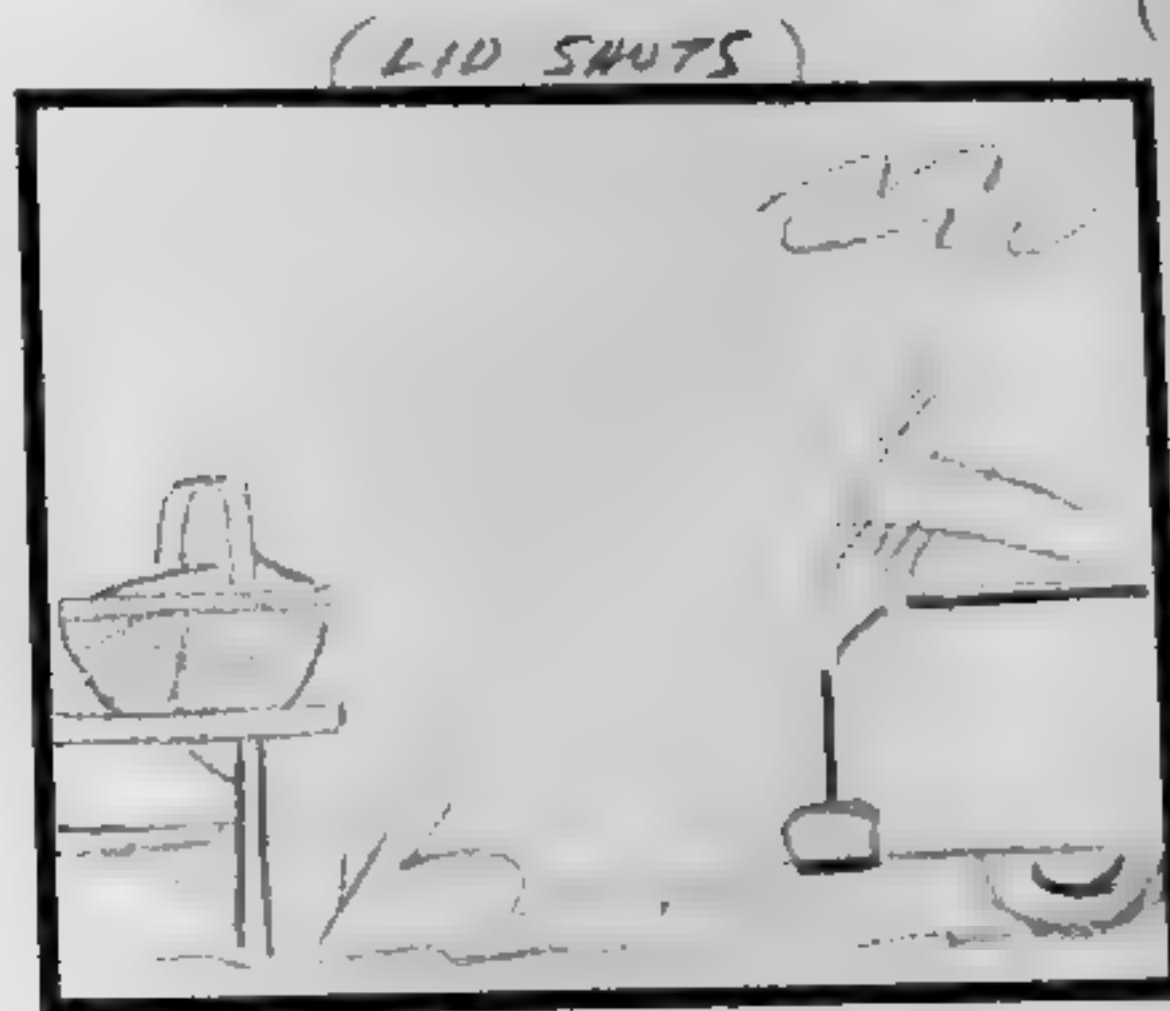
THE "MATTY BEAR" IS ABOUT TO STRIKE AGAIN!
BOO-BOO: NO, YOGI -- COME BACK!



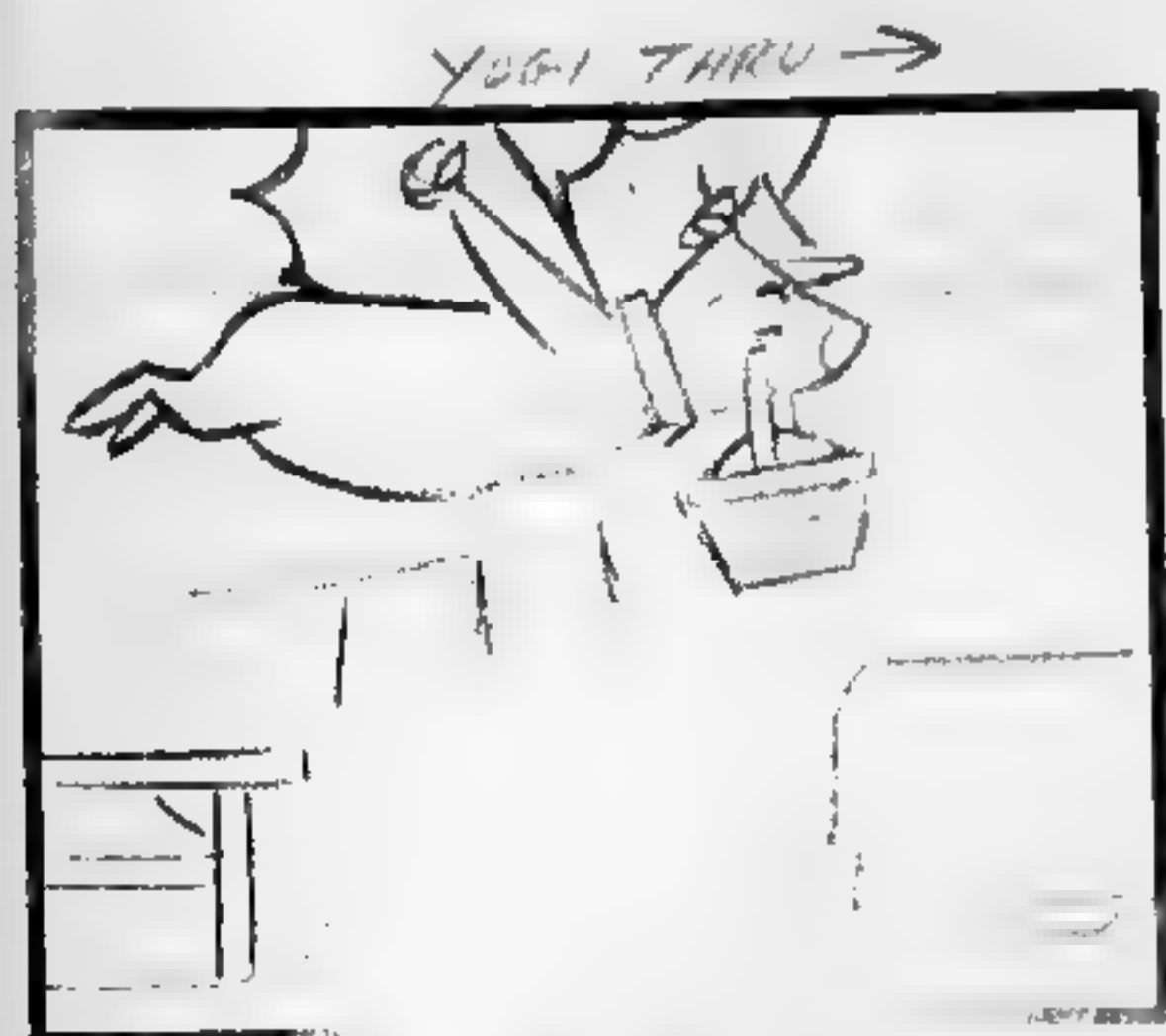
FX: DIVING PLANE



FX: ZIP



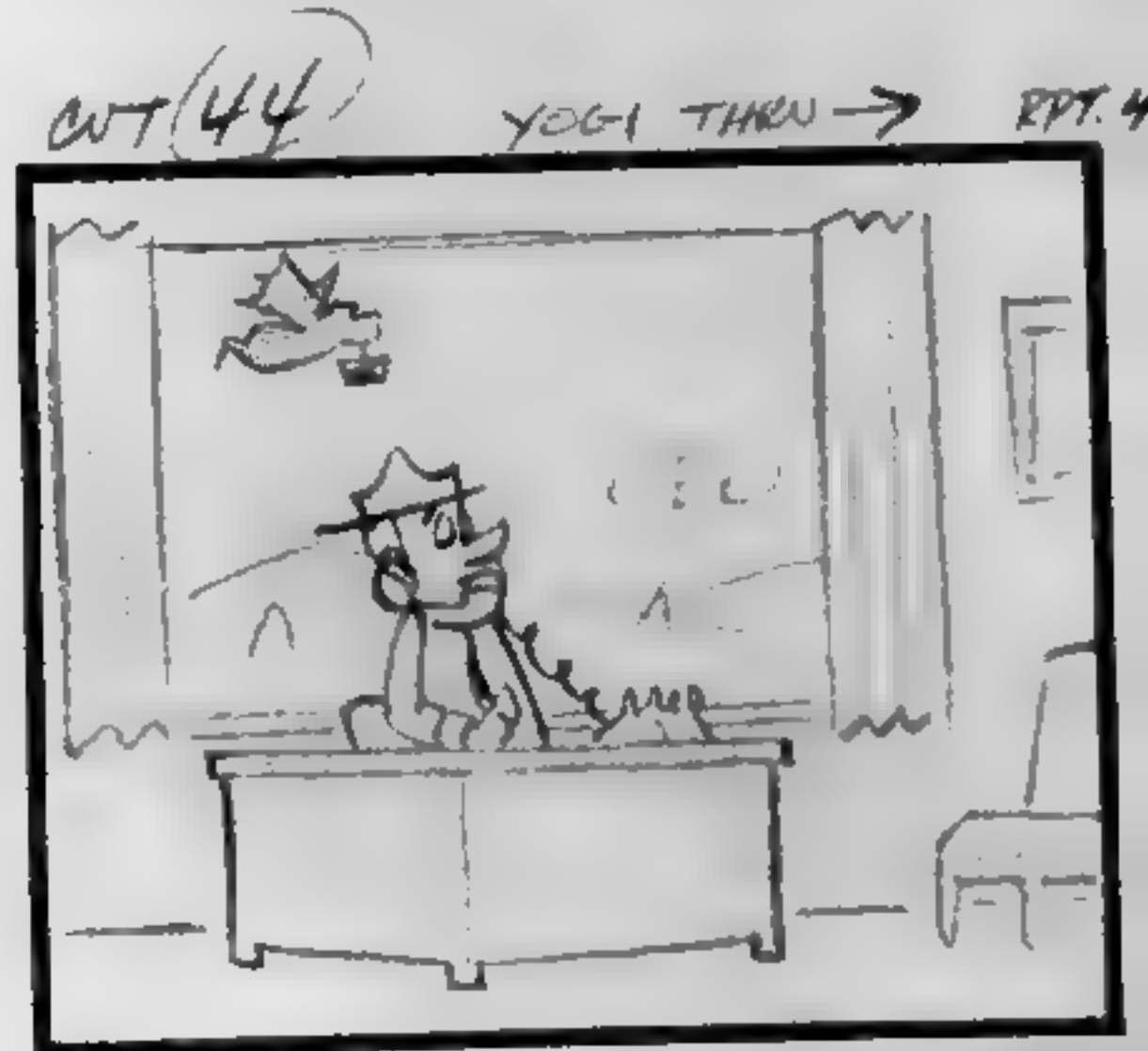
FX: CLUNK!



FX: S...



RANGER: BUT, LADY -- YOU COULD HAVE MISLAID THE BASKET -- WAIT A MINUTE, PLEASE -- LOOK



THERE IS NO SUCH ANIMAL --

such radically different frames. For these and other reasons the verbal and visual components of an animated feature need to be considered together rather than one after the other.

POSING FOR BUSINESS

To some people Bob Allen's pose reels for the early *Tom and Jerry* shorts might look now like an assembly of storyboard panels, while the kind of full-size "extreme" sketches that would in later years be widely referred to as *character layout drawings* might, when Joe Barbera drew them in the 1940s, have been thought of as "storyboard" artwork. This confusion of ever-shifting terminology creates a tangle from which it can be difficult to tease a genuinely straightforward history.

Broadly speaking, though, from a late-twentieth-century traditional-animation layout artist's perspective there were two basic styles of storyboarding: 'boarding for "business" or gags, and 'boarding that was more cinematic in its approach.

For pragmatic and economic reasons, the former lent itself (as it still does) to television or short-format work because it concentrates on the physics and the geometry of the character performances and places less emphasis on fancy camera work but, however accomplished or legible somebody's draftsmanship might be and however easy the character-based approach might be for the beginner to adopt, it's not necessarily best for the end product. As Charles Grosvenor pointed out:

There were a lot of animators who got into storyboarding as the tide rose in the '80s and there were fewer and fewer jobs but, while they were very good at posing out the characters for "business," the actual dynamism of camera angles and things just wasn't there.

GLORIOUS ARTSY-FARTSYNESS

Though the more cinematic approach to 'boarding pushed past "front of stage" and could include more detail and invention in terms of the characters' relationship to both the environment and the camera, in essence neither storyboarding style was (or is) wrong or right. The challenge for any Layout Department is to remember which medium they're working in and to know how best they can develop and "plus"² the material presented to them in the 'boards according to the project's visual style and available budget.

If the art direction and character design are simple and economic and the production resources don't stretch to anything more than the occasional truck in/out or E/W pan, it's up to the layout artist to find interesting and effective ways of working within those limitations. Indeed the limitations themselves can help and even inspire. Dan St. Pierre, who learned his trade working at TV animation studio Filmation, reiterated this idea:

The efficiency that we learned at the limited-animation TV studios became quite helpful in being able to manage quota at places like Disney. Because quota's a reality. You have to do a certain amount of numbers, even in feature. It's not all just glorious artsy-fartsyness; it is strictly business.

So before we look more closely at the feature animation process, let's see where the principles of "staging for business" paid off perhaps most handsomely of all—in the short-format traditional animation produced under a famously tight budget by the Warner Bros. "Termite Terrace" animation units.³

Endnotes

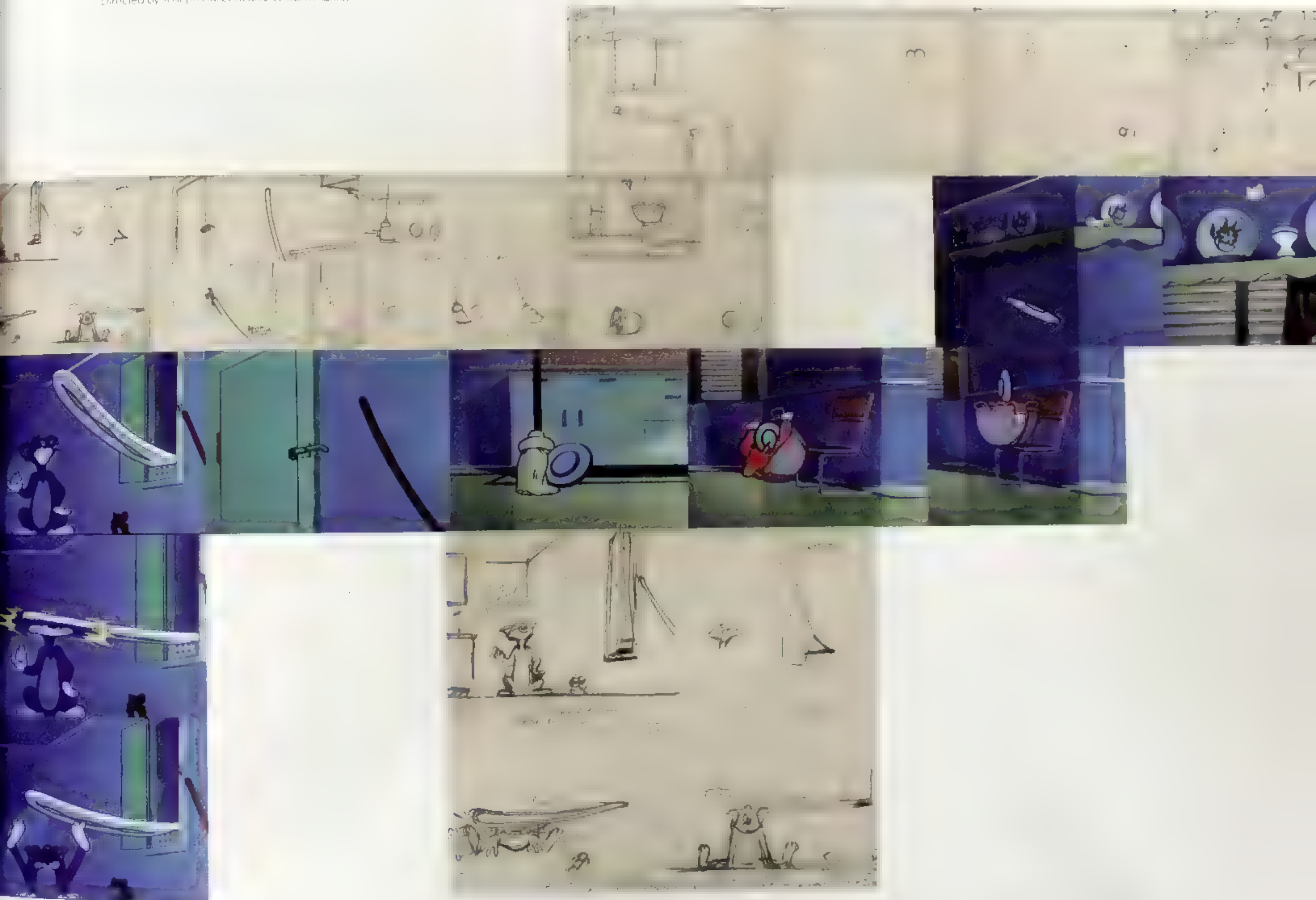
1. See glossary.
2. See glossary.
3. "Termite Terrace" was the name given by Tex Avery and his unit of animation artists to the temporary accommodation they were assigned to at the Warner Bros. lot after being moved from the original Schlesinger premises. It has since become something of a "catchall" name for the *Looney Tunes* and *Merric Melodies* shorts, no matter who directed them or where they were made.

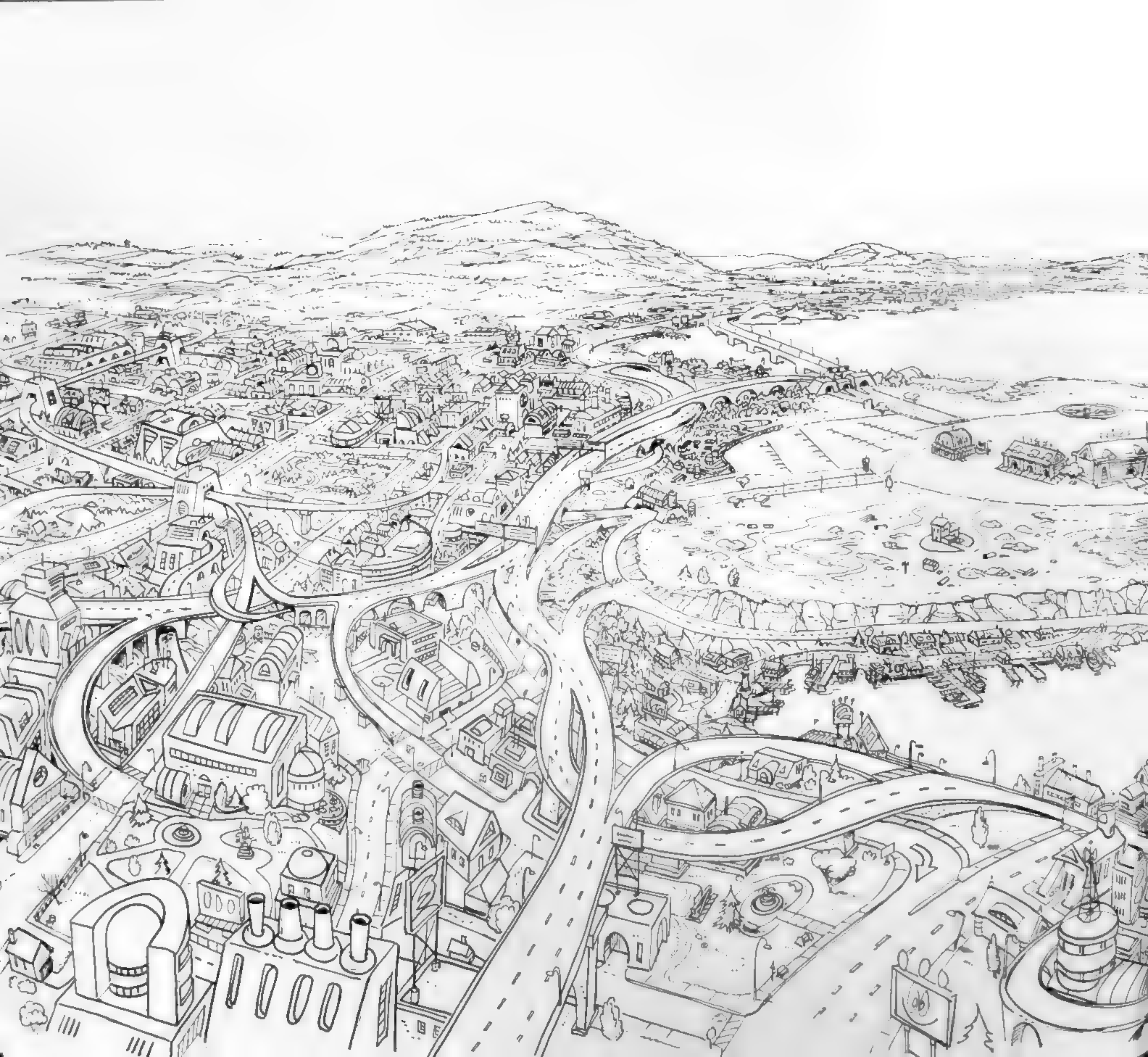
TOP A step-by-step comparison between the careful staging of a gag in Joe Barbera's original 4-to-a-page story sketches and the sequence as it appears in the final *Tom and Jerry* short. In most storyboards the individual drawings are sequenced left to right; this artwork is notable for the atypical way in which Joe Barbera's plotting of the action runs right to left from one sheet of paper to the next, reflecting the actual movement of the various props as the gag unfolds on the screen.

No Wily Kitty (1951) MGM Cartoons
Directed by Joseph Barbera and William Hanna

BOTTOM Joe Barbera "quadrant" drawings for the "payoff" of the gag: by throwing a piece of cheese away in disgust, Jerry inadvertently triggers a sequence of events that result in Tom being struck on the head by an ironing board.

No Wily Kitty (1951) MGM Cartoons
Directed by Joseph Barbera and William Hanna





Overall townscape design by layout artist Drew Gentle.
Firehouse Tales (2005)
Created by Sid Bailey, directed by Kathi Castillo and Jim L. Clark

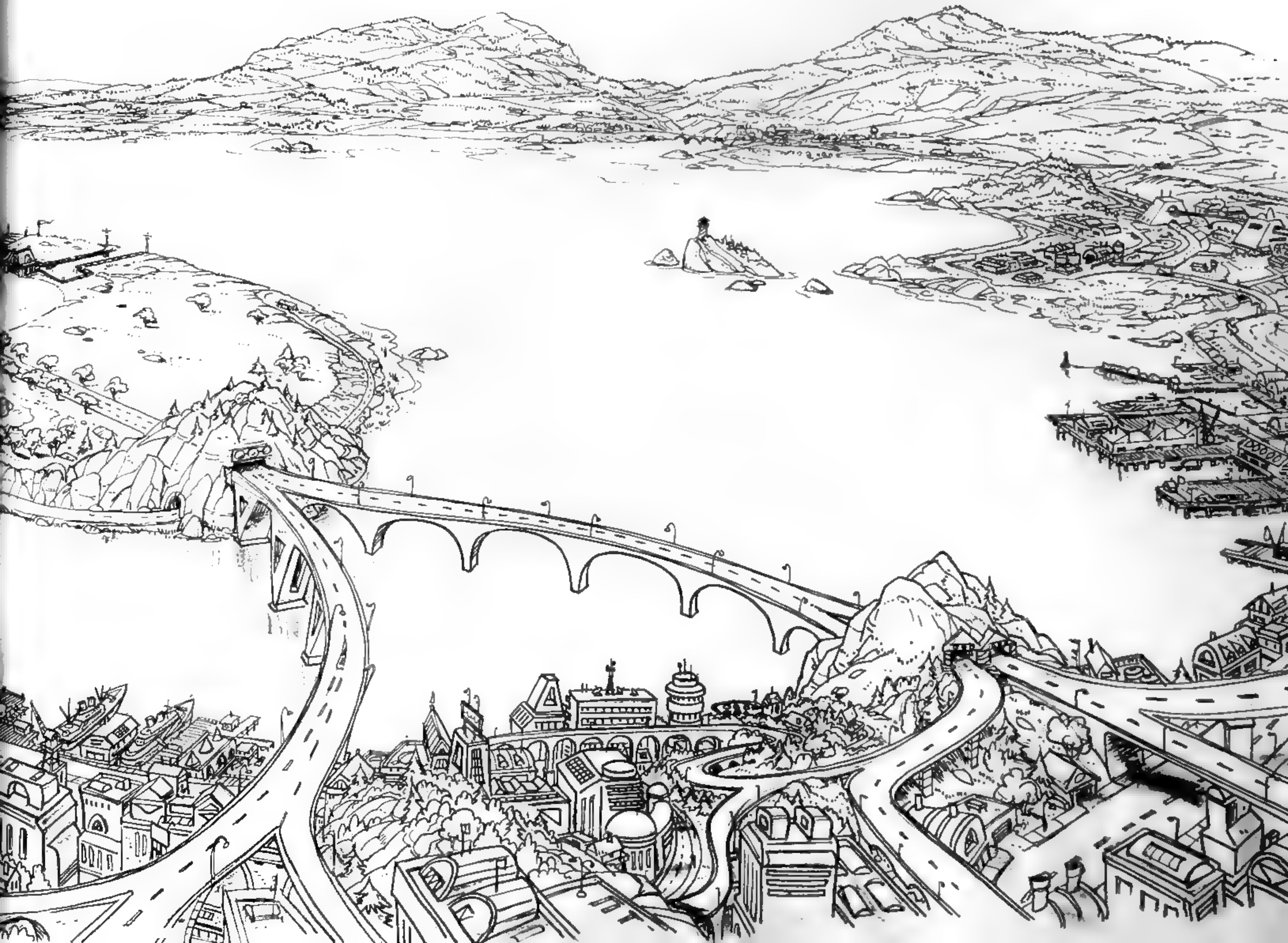
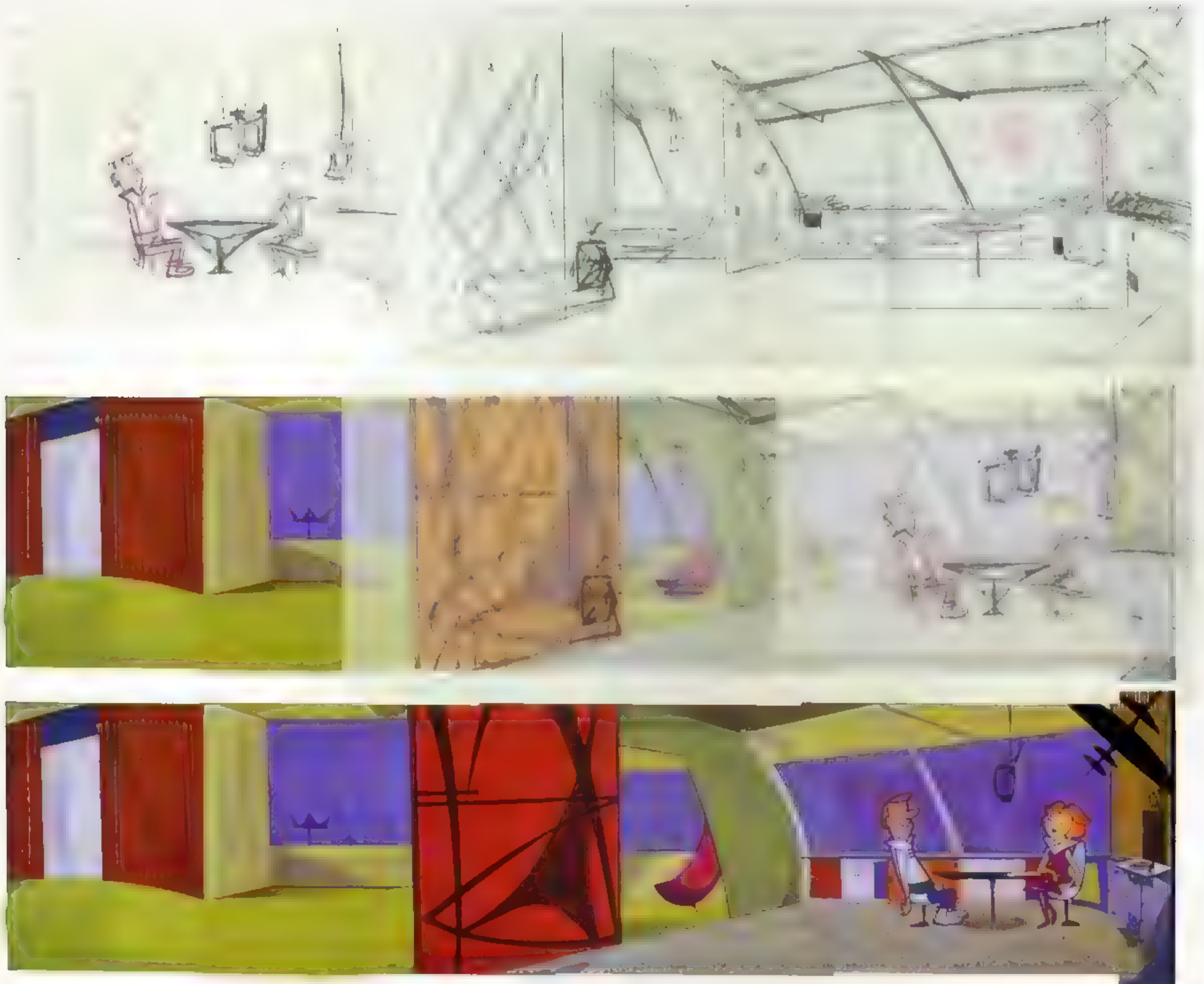


Figure 10.14 Character layout sketch by Irv Spector superimposed on rough BG layout drawing of the Jetsons' apartment interior with window. Frame enlargements and character cels of the same setup.



TOP, LEFT A held cel of all four members of the Jetson family (and Astro, the dog) showing the importance and effectiveness of clear character silhouettes and of a layout and BG design that allows them to be clearly "read" and identified by the audience.

County courthouse interior

Episode "5: Millionaire Astro" *The Jetsons* Season One (1963)

Hanna-Barbera Studios



TOP, RIGHT Studio memo (dated October 11, 1962) from Bill Hanna and Joe Barbera indicating the problem of "strobing" as experienced when a "repeat pan" background painting is not long enough, causing the same design elements to reappear too quickly (and in identical screen positions) behind the characters.

The Jetsons, Season One (1963)

Hanna-Barbera Productions

October 11, 1962

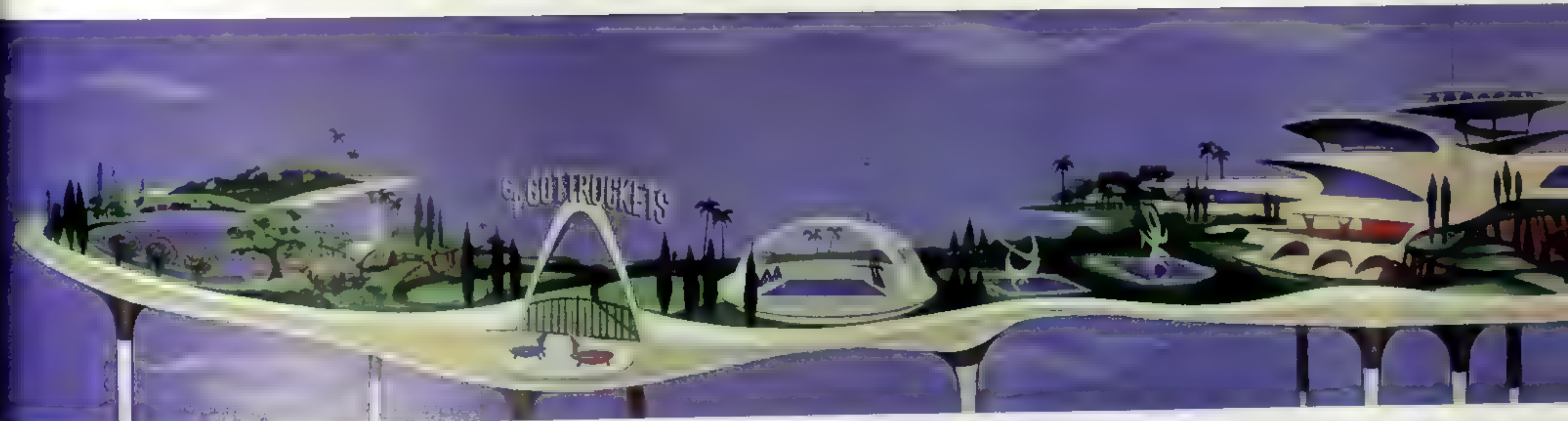
TO LAYOUT & BACKGROUND DEPARTMENTS:

In the JETSONS show of 10/1 "The Space Car", the designs on the pans are so short that if the pan moves fast enough we get a strobe effect on the background design.

Where we are trying to get a speed effect in our backgrounds, both the layout department and the background department should lengthen the design or pattern of these shapes in the sky so we can move them thru at 1 1/2" or 2" per— and still get movement and speed.

It might be a good idea to examine work presently on your desks in the layout department and to check out this particular thing. The background artists should examine the layouts before they are painted and if this has not been corrected in the layouts, please make adjustments before painting the backgrounds. Even backgrounds that have been completed should be checked if they have not yet been shot to make sure that this has been corrected.

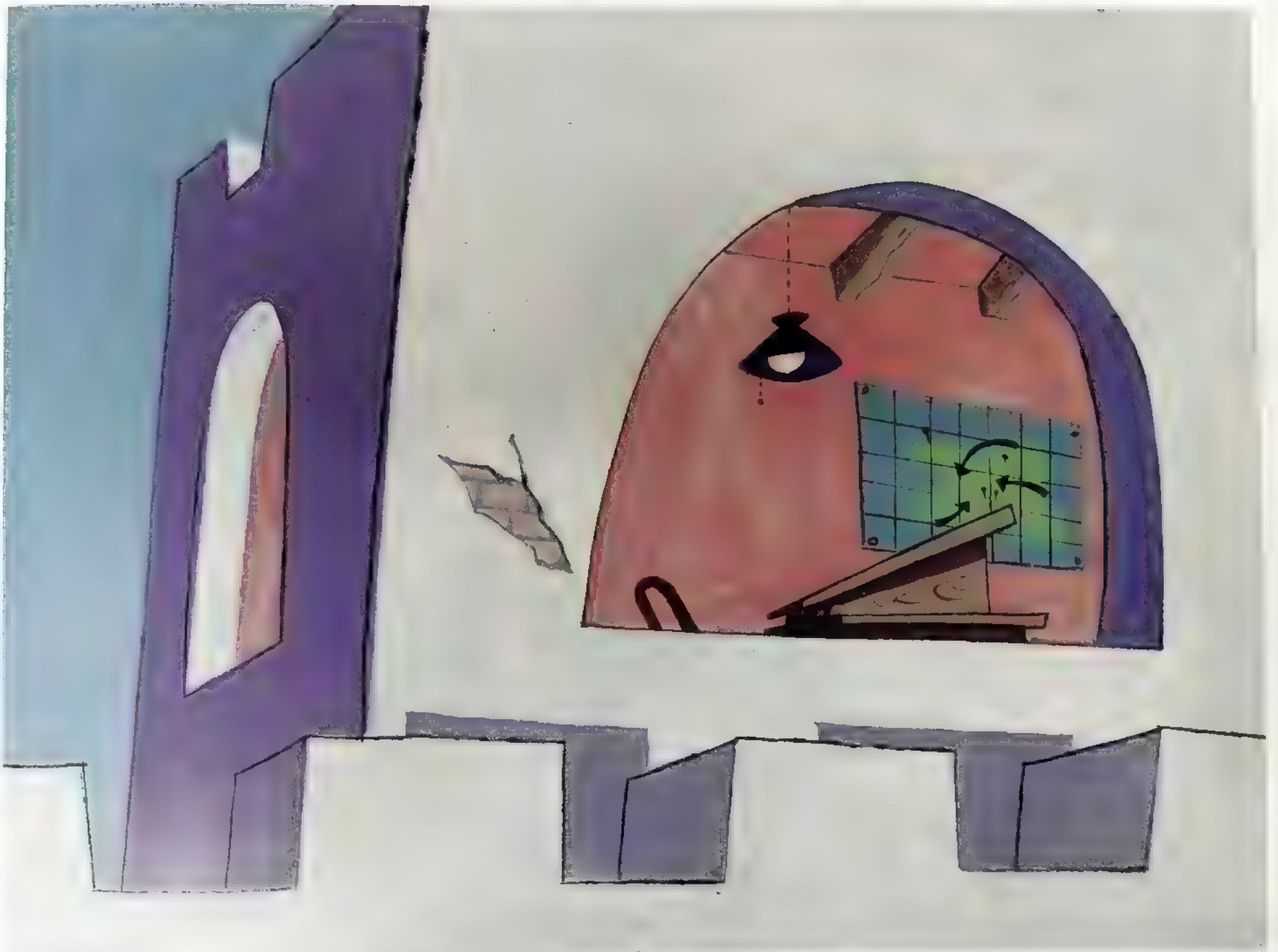
Bill & Joe



LEFT AND RIGHT: Two establishing shots employing subtly different viewpoints; in computer animation, once each 3-dimensional set or environment model has been built, the director can use a "virtual" camera to explore the space and decide on different ways of framing the same geometry; in hand-drawn animation every new

camera setup requires a unique layout drawing and the creation of a separate piece of painted background artwork.
BG painting by Tom O'Loughlin, layout by Hawley Pratt
Film title unknown (circa 1964)
Directed by Friz Freleng





6

STAGING FOR BUSINESS



CLIP

2 1/2" LEFT 2"

“[Maurice Noble] created a world where animation could flourish.”

CHUCK JONES

talent. As a result, many of their younger artistic charges now occupy key positions at top studios. I first met David Burgess when he was working as a lead character animator at Walt Disney Feature Animation in the 1990s; now a supervising animator at DreamWorks Animation, Dave was lucky enough to help out on some of Chuck’s short projects:

It was really great getting the chance to work with Chuck directly because you’d get the background layouts which were generated by the Layout Department and then Chuck would generally do the character layouts on top of those. He would also give you the X-sheet with these very specific timing notes. That’s very different than the feature model, which is that you get the background layout drawing, you get the character layout drawing, and you get a blank X-sheet with maybe the sound broken down. But for Chuck, when the poses changed in time was almost as important as how the poses looked. So it was really awesome to get the chance to see and handle those character layouts.

Chuck’s daughter, Linda, also emphasized how significant these exposure sheet notes were to her father. She was keen to stress their importance to animation students, many of whom now work almost exclusively in the digital environment and, for that reason, rarely have the chance to see handwritten exposure sheets and timing charts, let alone grasp the practical importance of “live” drawing:

The way Chuck did it was in sequences and scenes. He did all the keys in his layouts. There was nothing left to chance. He would give out a sequence or a scene to the animator then he would go through, and while he was talking to the animator he would do more drawings to show exactly what he wanted to happen, like a director talking to an actor.

While a 90-minute feature movie had to earn and keep the audience’s attention, the most successful and durable of the animated series that were designed originally for theatrical release tended to center around clearly delineated characters, often working in pairs and following a simple comedy formula that allowed the opposed personalities to read vividly while remaining much the same in all situations. In many respects, perhaps even more so than series animation for television, this format demonstrates staging for business at its very best.

The main ingredients of this formula derive, of course, from the ancient comic traditions of live theater and therefore predate both cinema and vaudeville. The medium of hand-drawn animation, however, allowed one other powerful component to be added to this well-established mix: in place of the fire curtain or neutral, street-corner backdrop that stage comedians would be expected to work with, a flexible and immediately recognizable cartoon environment could be created as graphic support for the personal dynamic of any animated duo, operating almost as a third character or “straight man.” The eternally vulnerable *Tom and Jerry* house interior would be one example, while Maurice Noble’s impersonal, sun-parched desert would be its obvious equivalent in the *Road Runner* shorts.

Though endlessly adaptable, the beauty of these signature environments lay in the clear and finite parameters they helped establish, against which the character performances could be elegantly staged and within which the gags could be set up

confidently and legibly. Layout for “business,” as we might think of it today, was still identifiably theatrical in comparison to the realism required of much contemporary CG feature design. Chuck Jones’s daughter, Linda Jones Clough, made this clear when she described the design double act her father forged over the years with layout designer Maurice Noble:

It was character driven, and the backgrounds were designed around the character movements. A lot of people don’t know what the “fourth wall” is now. But Maurice, of course, was very much in the proscenium arch, making sure that everything supported the acting.

CHUCK AND MAURICE: THE WARNER BROS. PIPELINE

The creative partnership of Chuck Jones and Maurice Noble must rate as one of the best known and most productive working relationships in the history of animation design. In spite of numerous feature and television credits, it’s for their work on the Warner Bros. cartoons shorts that both men are justifiably recognized and remembered. It is within the fantastic visual library of the *Looney Tunes* and *Merrie Melodies* that we can find some of the clearest examples of the vital relationship between character animation and environment design, or, more specifically, between character layout and background layout.

In the course of their long careers, both men made a point of fostering and encouraging new

PREVIOUS: Character key poses by Chuck Jones.
Louvre Come Back To Me! (1962)
Codirected by Maurice Noble
Backgrounds by Tom O'Loughlin & Philip De Guard

LEFT: Original *Tom and Jerry* BG layouts overlaid with frame enlargements.

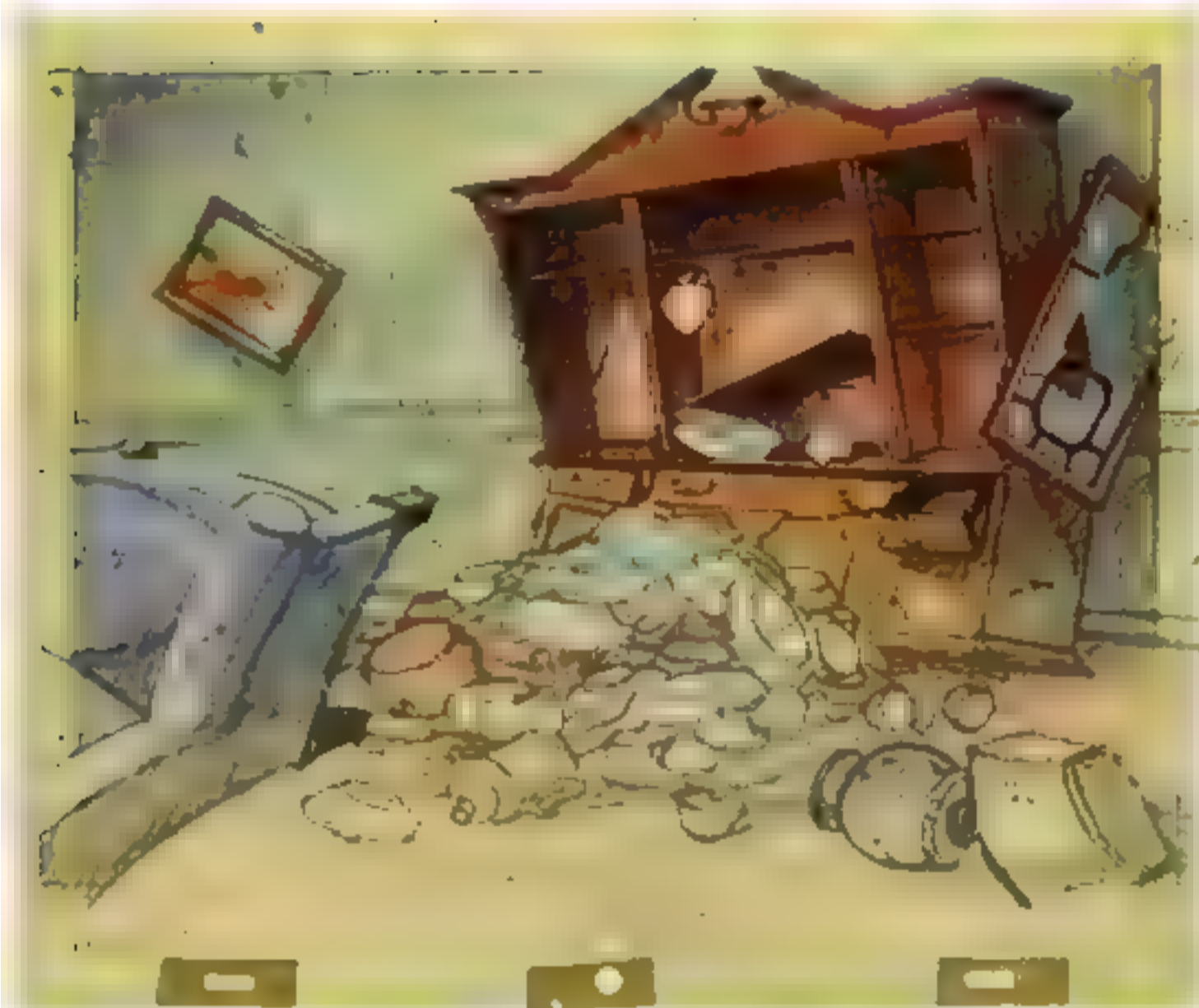
(layout artist uncredited, possibly Dick Bickenbach;
background artist uncredited, possibly Robert Gentle)

TOP: Scene 69 *The Little Orphan* (1948) MGM Cartoons

BOTTOM: Scene 38 *Mouse Cleaning* (1948) MGM Cartoons
Directed by William Hanna and Joseph Barbera

RIGHT: Sweeping perspective and a powerful central "hot spot" of light lead the eye immediately to the stage in this opera house interior.

Original BG layout drawing and camera fielding guide
(layout artist uncredited, possibly Tex Avery or Dick Bickenbach)
Scene 10, *Magical Maestro* (1952) MGM Cartoons
Directed by Tex Avery



Jones's character poses and timing notes also played a central role in the improvisational approach he and Mike Maltese developed to the formulation of both story and script. With her father's trademark mischief still very much in evidence in the tone of her own voice, Linda went on to describe the process:

The general idea of what the story was going to be was already in place, but the dialogue was never settled until after the character layouts had been done because so many things came to Chuck and Mike as the process was developing. Then, after all the character layouts were finished, they would take the dialogue and type it up on a piece of paper. That typed script would then go to the voice recording session with Chuck—but even then he might change things. So the story, or the dialogue at least, wasn't set in stone until the actual voice recording was finished. It was a very organic process.

THE PENNY DROPS

Even after many years of working commercially on both sides of the Atlantic, animator Greg Duffell found some of his own assumptions and preconceptions about layout design being challenged by yet another of the greats of Warner Bros. design; before returning to set up a studio of his own in his native Toronto, Duffell had the enviable opportunity in the late 1990s of working at Chuck's studio in Los Angeles alongside Bob Givens:

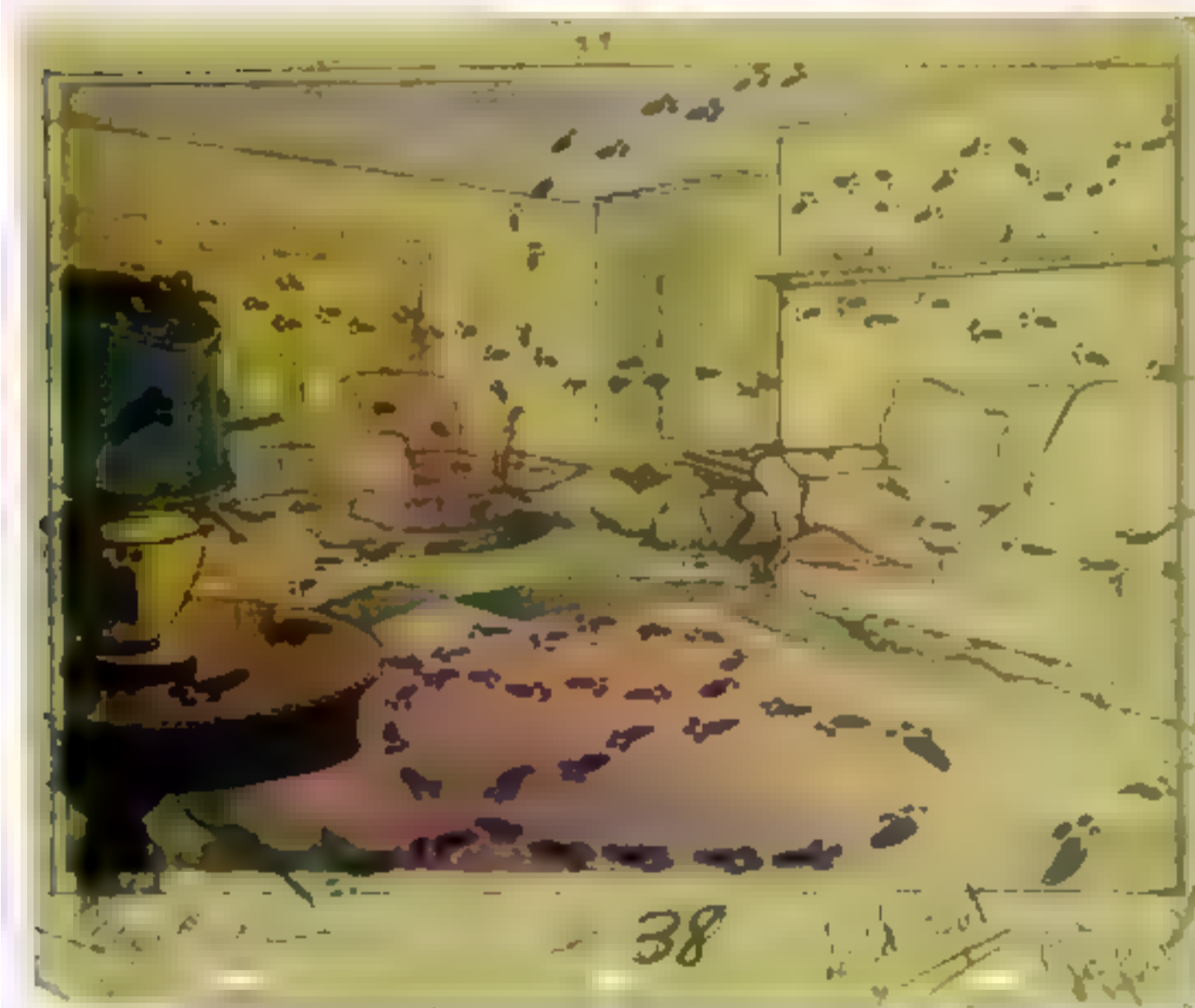
I knew Bob had been in the business since the late 1930s so I was thrilled to be working in the same building as him. He was extremely vital, an incredible hard worker. He would come in at 8:30 A.M.; he would do the same routine that

I'd seen Ken Harris do, that same Warner Bros. routine. These were 9-to-5 artists and they just came in, knuckled down, and pushed out a lot of stuff!

But what Bob told me that I first thought was the strangest thing, but made the most sense to me of perhaps anything I'd ever heard about doing layouts, was that the background layouts at Warner Bros. were all done *after* the animation had been done. And that really surprised me. I just started wondering about all of the logistics of this, how would this get done?

Bob would have all the rough animation available at his desk and he would be able to reference that in terms of creating the scenic layouts to make sure that the background didn't somehow interfere with what was going on with the characters. But this runs completely counter to the way that many people have been taught layout at college. They're told perhaps to do a storyboard in the first place, then to draw a complete background and only then place the characters into the scene.

And, of course, when Bob told me this, the penny dropped! I thought, "Well, this makes complete sense of why Chuck would do all of these character layouts and why there were only very vague indications of where the background detail and the horizon line were. Chuck would draw the characters the size that he wanted them in the frame, at the angle that he wanted them, and everything would be built around this." I'm sure that maybe not everybody worked this way, but it made complete sense. So that really changed my whole way of looking at things and understanding one way that good animation could be done.





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TOP LEFT The hypnotic perspective of an endless road as seen in the hallmark "impersonal, sun-parched desert" created by Maurice Noble for the Wile E. Coyote/Road Runner series of shorts and TV shows.

BG painting by Philip De Guard. Layout by Maurice Noble
Lickets Splat (1961)
Directed by Chuck Jones & Abe Levitow

TOP RIGHT The regular elevation of Maurice Noble and Hawley Pratt to codirector status in the on-screen credits for many of the Warner Bros. shorts gives a clear indication of the pivotal role played by the layout artist in the planning and staging of the action.

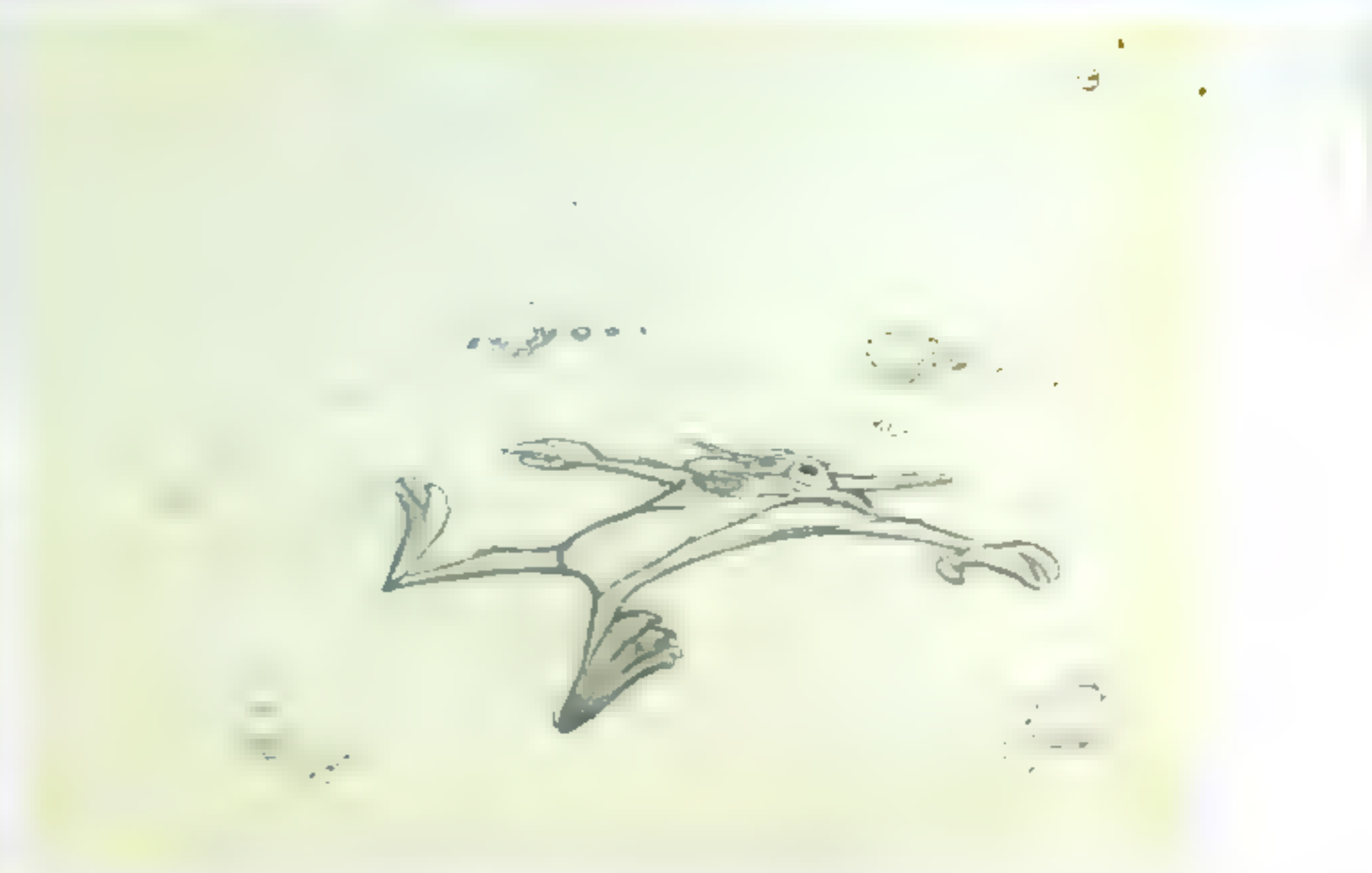
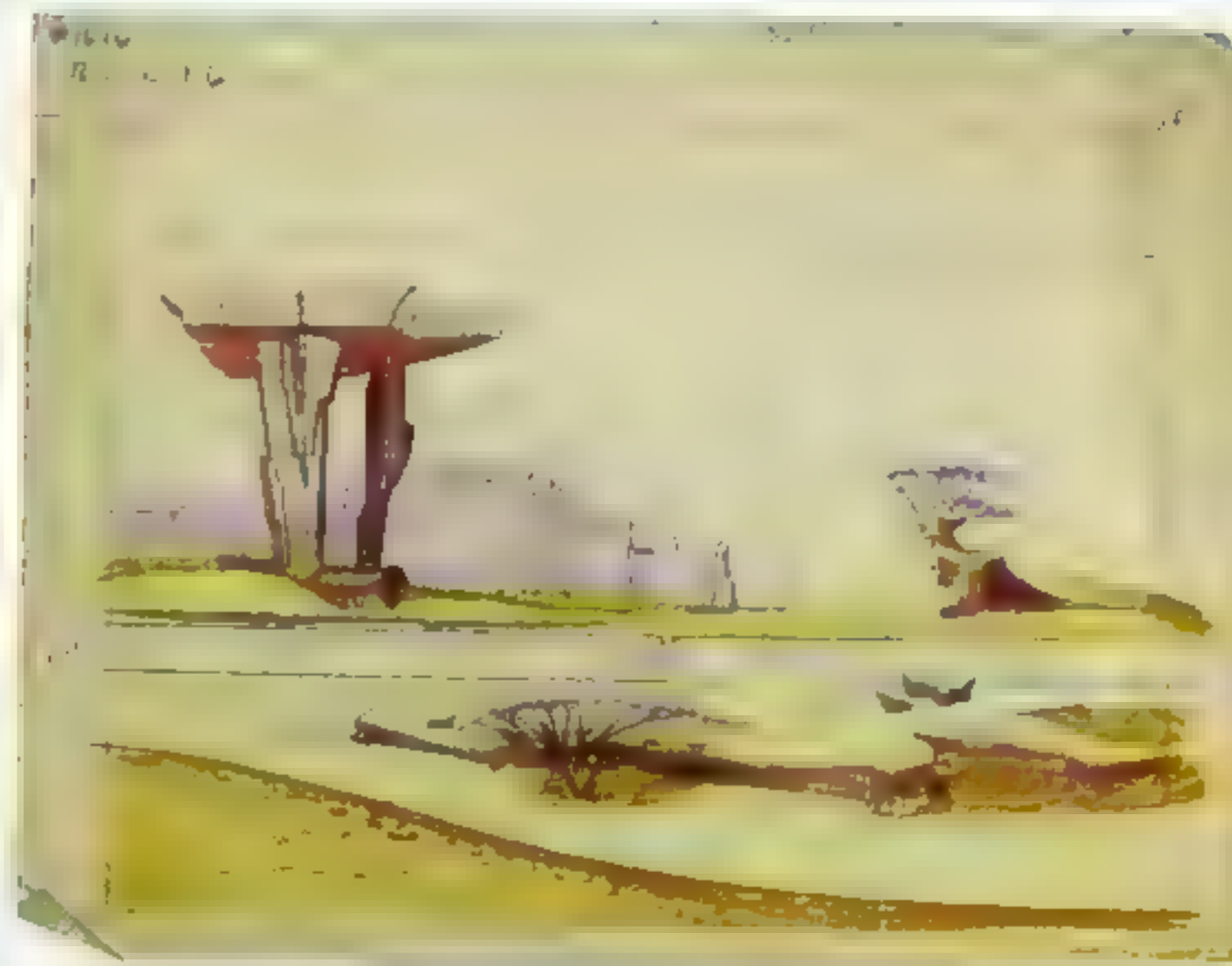
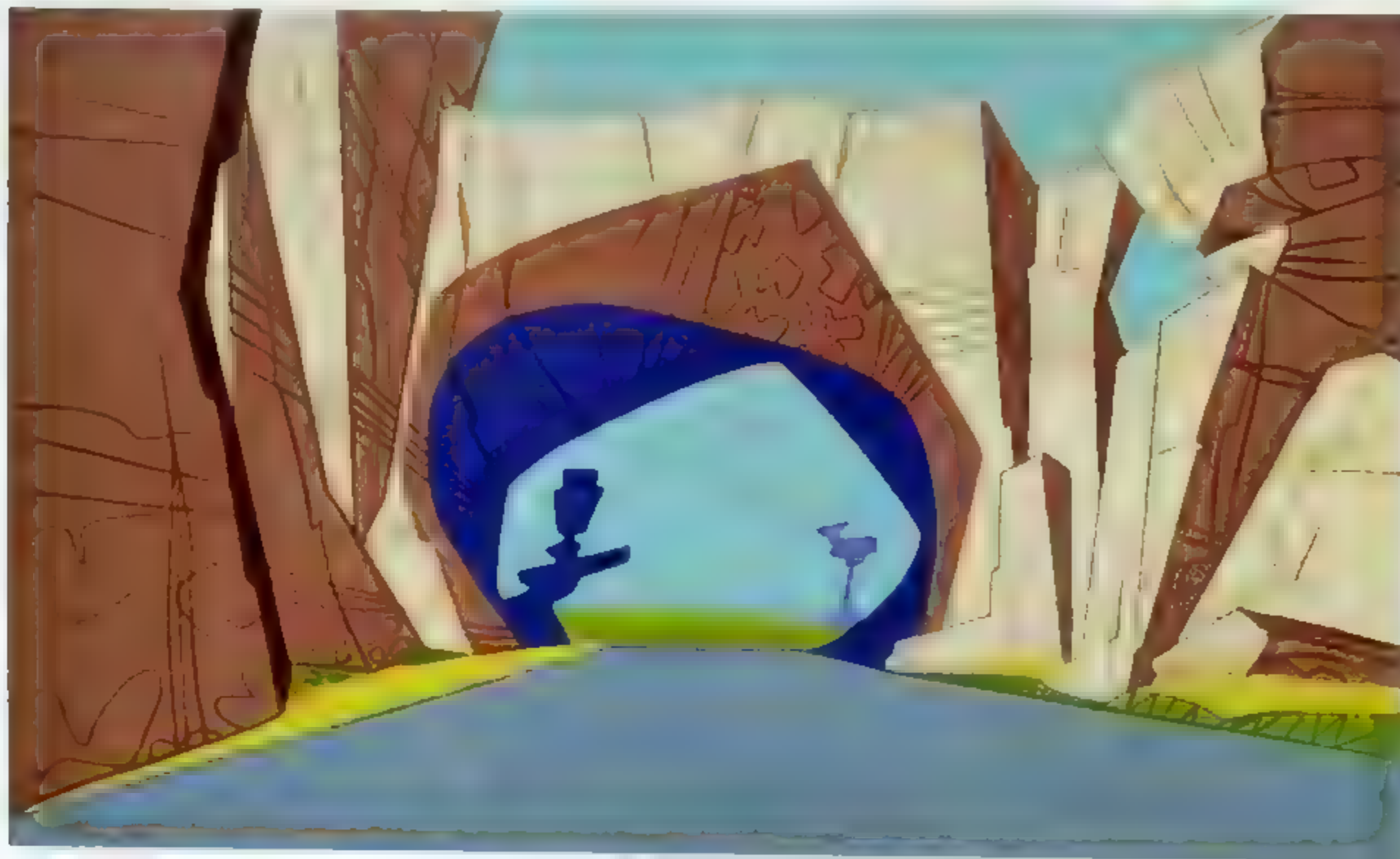
BG Layout drawing by Maurice Noble
Hare-Breadth Hurry (1963)
Directed by Chuck Jones
Codirected by Maurice Noble

BOTTOM, LEFT Rough character key drawing by Chuck Jones.

Gee Whizz-z-z-z-z (1956)
Directed by Chuck Jones
Layouts by Ernie Nordli
Backgrounds by Philip De Guard

BOTTOM, RIGHT Rough character key drawing by Chuck Jones.

To Beep or Not to Beep (1963)
Directed by Chuck Jones
Codirected by Maurice Noble
Backgrounds by Philip De Guard



"Well, Sylvester, here we are, back in civilization..." Drama, as they say, is conflict. Sylvester's nervous expression immediately tells us what he makes of Porky's idea of "civilization"; as the camera pans to reveal the background, the contradiction becomes even stronger in the next image

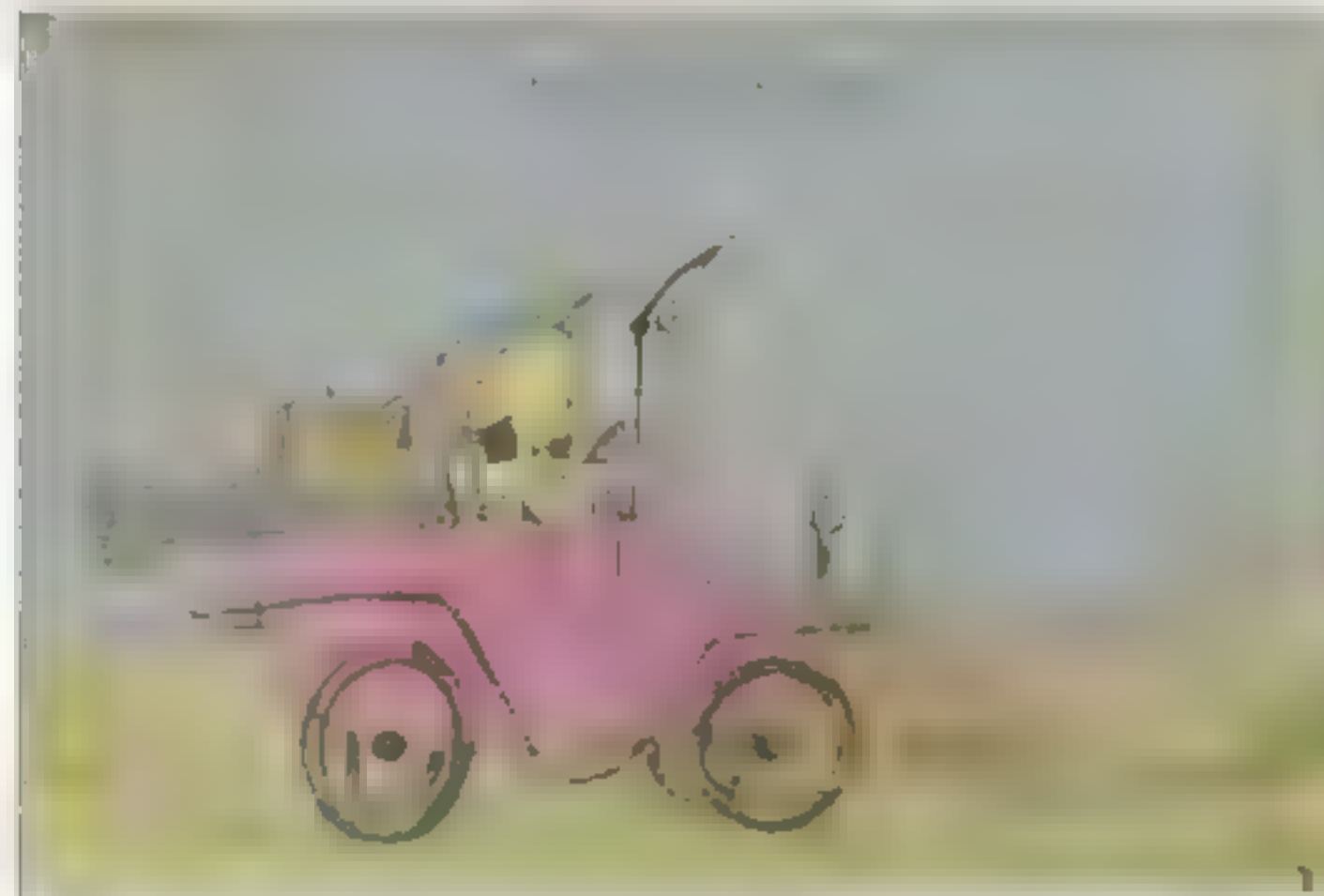
1. [Landscape background for Sylvester the cat](#)
2. [Landscape background for Sylvester the cat](#)
3. [Landscape background for Sylvester the cat](#)
4. [Landscape background for Sylvester the cat](#)
5. [Landscape background for Sylvester the cat](#)

STORY, DESIGN, AND "THE NOBLE BOYS"

Just as Chuck Jones had, over the years, helped foster the talent of aspiring character animators like David Burgess, and just as Bob Givens had been delighted to pass on his own knowledge and experience of layout to Greg Duffell, with Chuck's encouragement, Maurice Noble found himself, in the late 1990s, at the hub of a group of young CalArts graduates who had been brought on as interns at Chuck Jones Productions and eventually came to be known as "The Noble Boys." One of these young designers, Scott Morse, now a story artist at Pixar, learned from Noble how important it is to explore the possibilities of layout and even color design from the earliest stages of the creative process:

When he was working with Phil DeGuard and a lot of the actual BG painters, Maurice would do what would be looked at now as a color script or development art. But they would be actual shots from the films, and a lot of times what he would do is sit in on story meetings with Chuck and Mike Maltese and watch the 'boards, see what was going on, see where the acting needed to be framed.

Maurice was very much of the mind where Pixar is now: story comes first! Everything goes back to the story, even the design. Every shot composition has to go back to "What's in the best interests of telling the story from that point of view?" He was always very much about framing the story and framing what was going on with the characters. The backgrounds were never supposed to get in the way unless it was a transitional device or some sort of "background spotlight." Everything was to focus on the gag or the mood of the moment, so he'd be there from the story phase on out. He was instrumental in teaching us, "Pay attention to the story!"

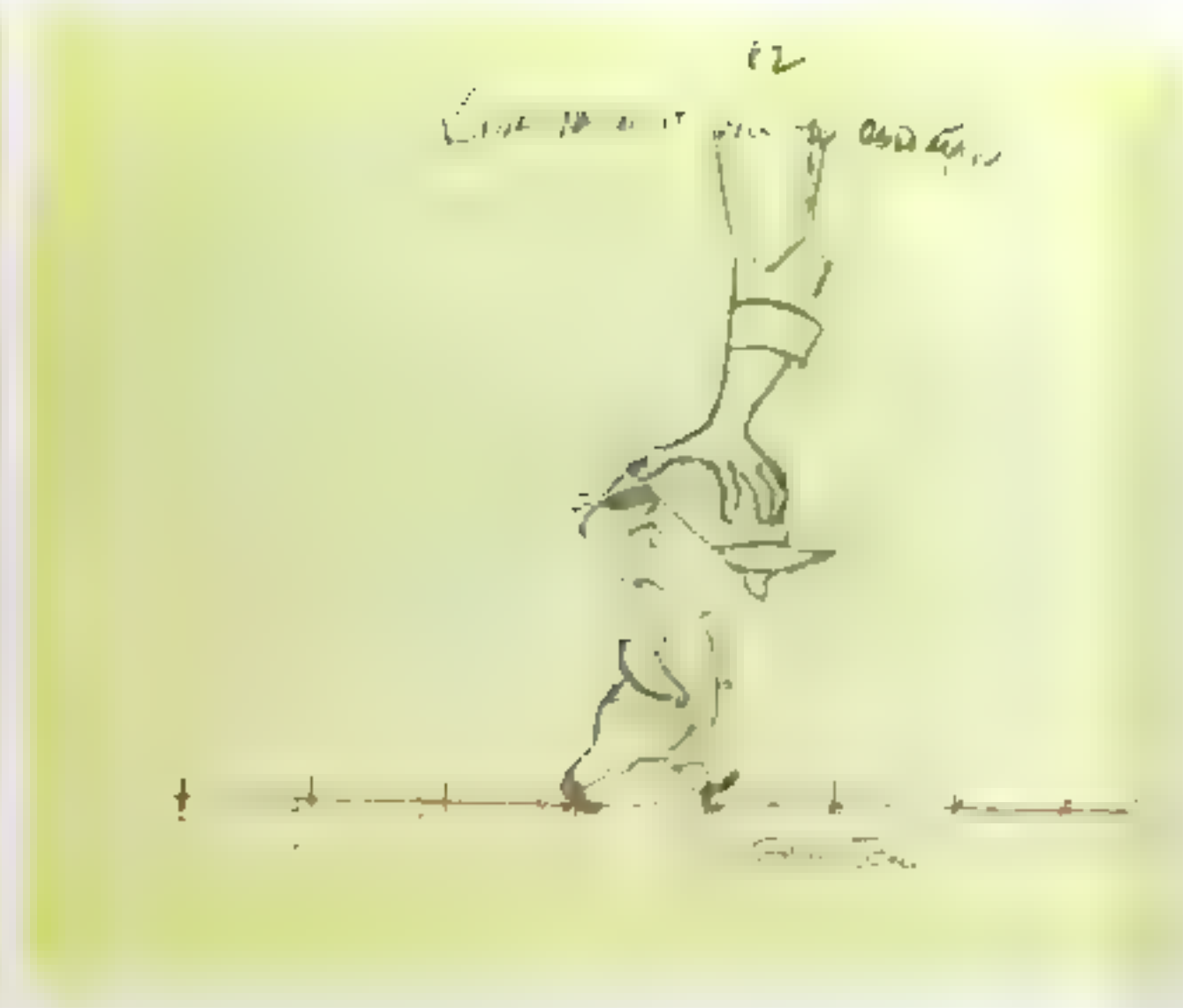
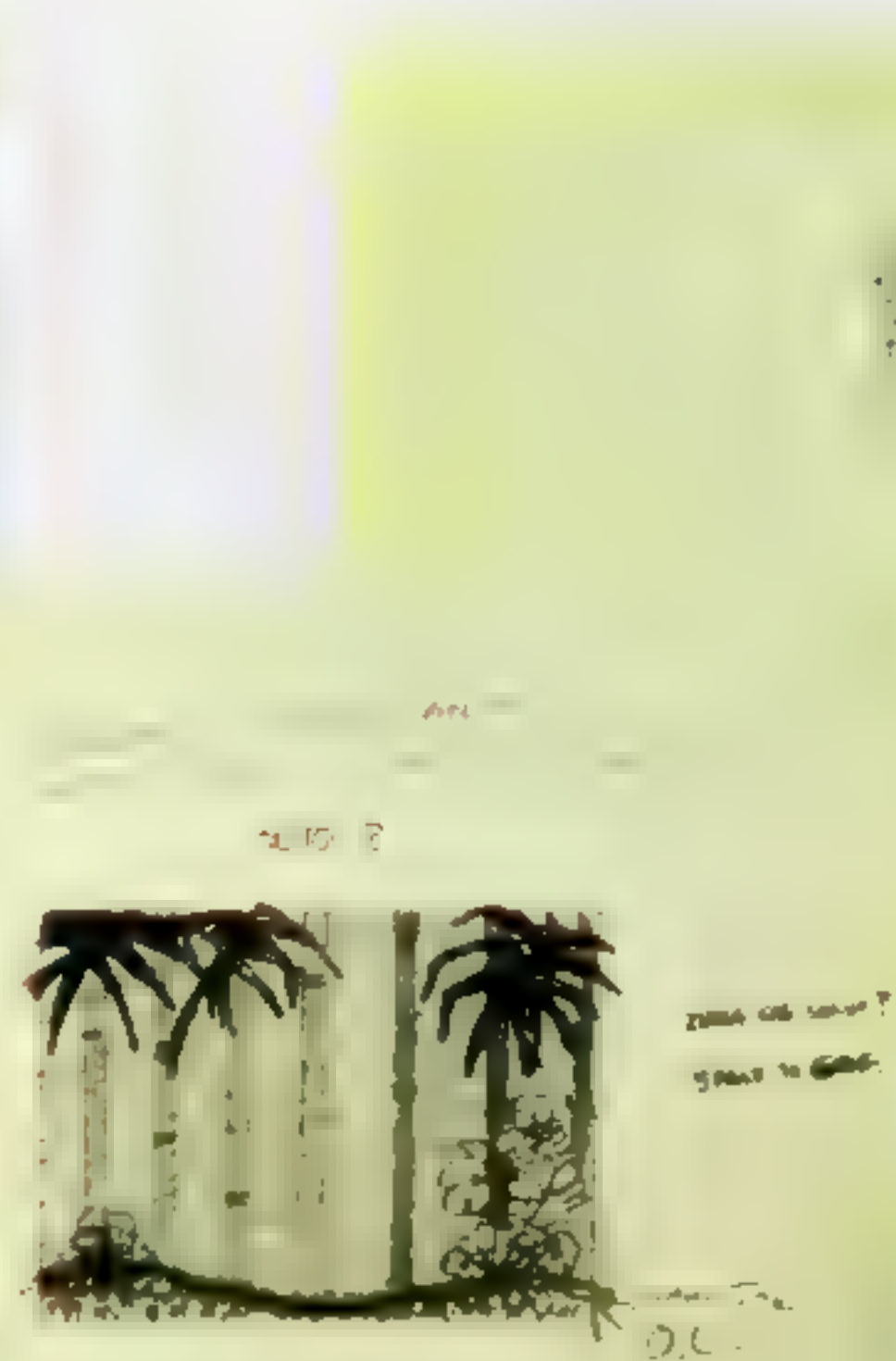
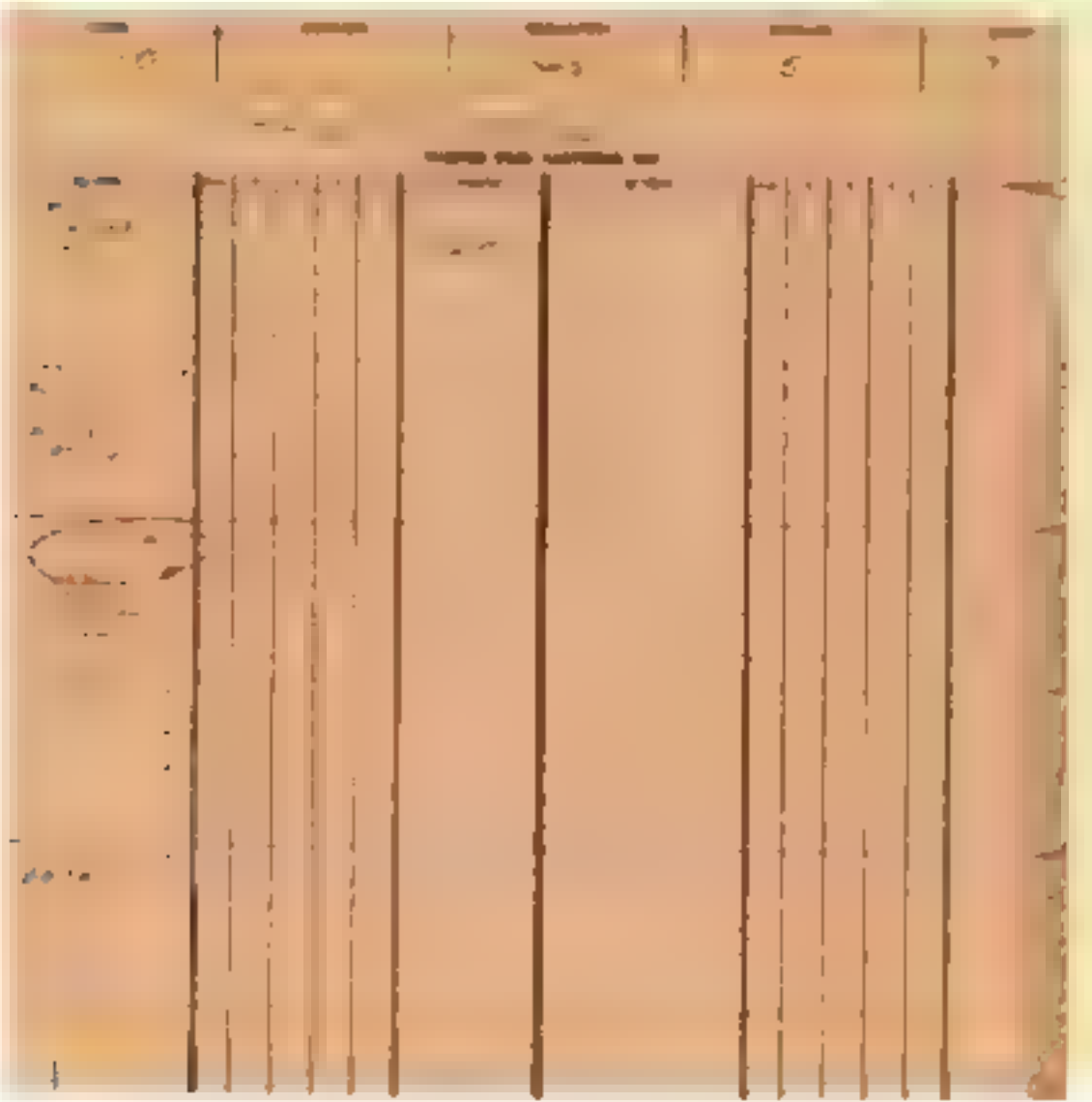
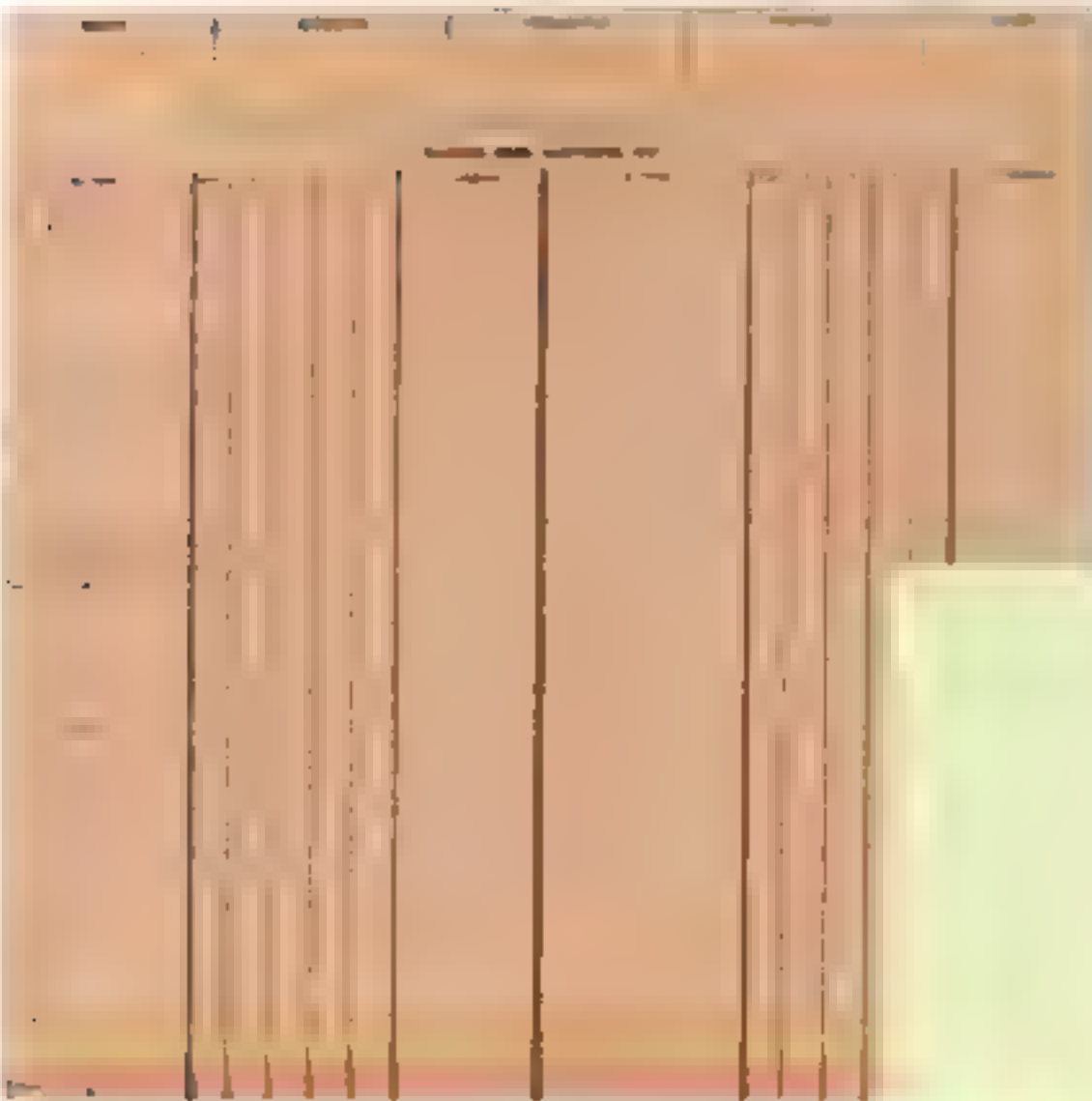


Annotated exposure sheets, character layouts, paths of action, walk cycle increments, and BG sketch by Chuck Jones.

Boyhood Daze (1957) directed by Chuck Jones

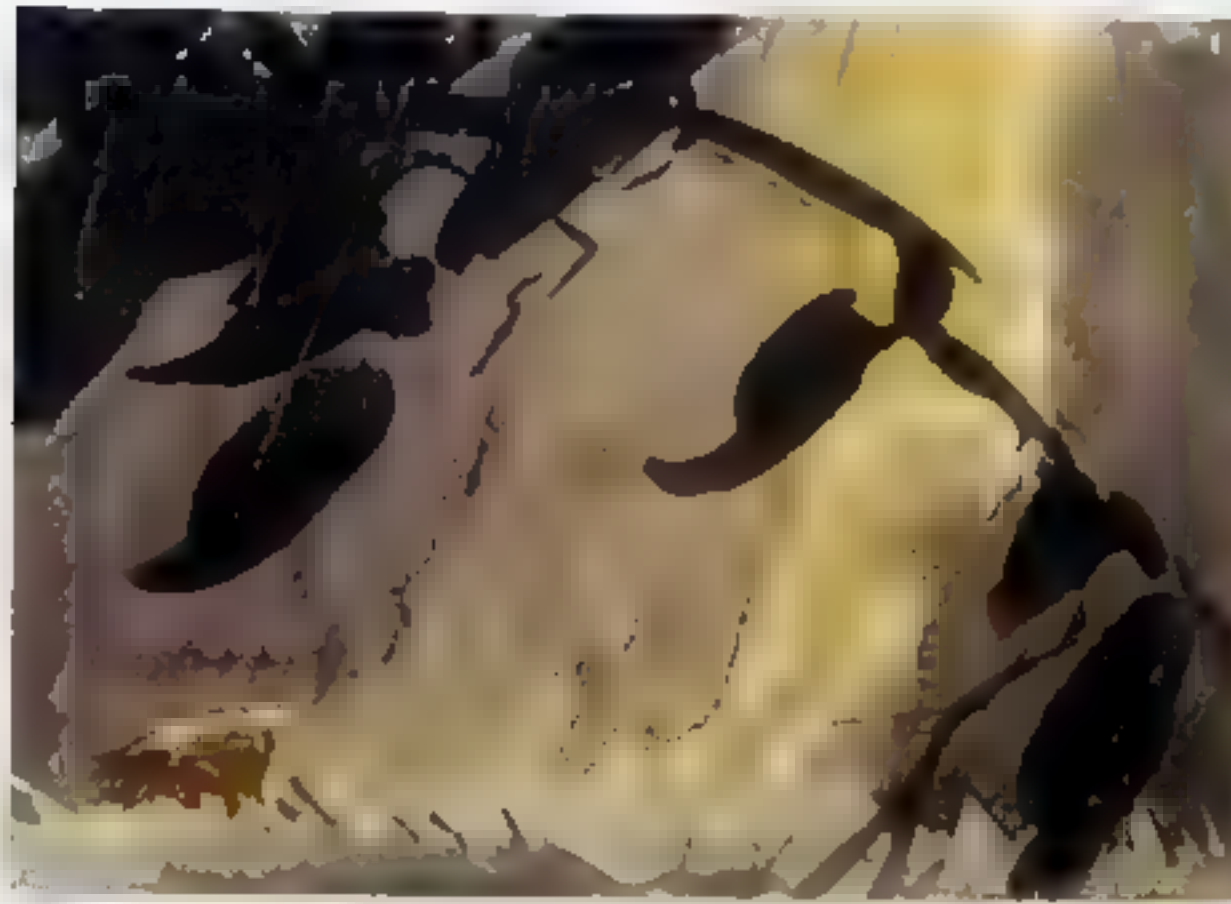
Layouts by Maurice Noble

Backgrounds by Philip De Guard



LEFT Noble was one of many artists who worked in the background department on Disney's *Bambi* in which subtle watercolor and wash techniques combined with Tyrus Wong's elegantly simplified scenic designs to create striking and effective frame compositions.

Color concept sketch, watercolor, by Tyrus Wong
Bambi (1942)
Supervising Director, David D. Hand



RIGHT Noble used ordinary cel paint to create simple color sketches which he provided as guides for Philip De Guard and the other Warner Bros. BG painters. These designs had a strong influence on the younger animation designers whom Noble mentored over the years and their influence can clearly be seen in contemporary "color script" designs (see pages 202 and 203).

Original watercolor background concept by Maurice Noble
(circa 1953)



By the time the group came to know him, first at Chuck's studio and later during his tenure as design mentor at Turner Feature Animation, Noble already had more than sixty years of experience to his credit. Another of the Noble Boys, Tod Polson, with whom Maurice was working at the time of his death in 2001, emphasized the role Noble's own training, and in particular his powerful color sense, played in his early work at Disney:

Maurice was trained to do watercolors at Chouinard [Art Institute]. I don't remember if it was on the *Silly Symphonies* or *Snow White*, but he said he helped set up the Color and the Color Checking Departments. One of the last things he did at Disney was *Dumbo*. It was interesting: he got a credit as a character designer on that film, but he set the color on all of the "Pink Elephants" stuff, the whole thing. He just did whatever felt right to him. It was more about emotional color, where a lot of the other designers were doing more realistic colors.

The *Looney Tunes* characters were painted with cel paint, so he always felt that the world the characters lived in should have the same sort of feel. He talked about the time when he was doing *What's Opera, Doc?* and he was painting Elmer red and all kinds of weird colors. The girls from the Ink & Paint Department would go up to him and say, "Maurice, are you sure this is what you want?" and he would say, "Yes! Paint it!" He told me later that he wasn't sure it was going to work at all. But he just had to try because, as he said, "If you're not taking chances, then your work probably isn't going to be very interesting."

COLORFUL ATTITUDE

Though some artists now do initial their sketches and designs, few of the finished paintings or pencil drawings that have survived from the 1930s and early '40s carry a specific artist's signature, so as I moved from one studio archive to another, I became more and more curious about the division of labor at the different animation companies. Having spent so much time talking to Maurice about his methods, Scott Morse has been able to absorb a gold mine of information about the precise workings of the design and production processes at Warner Bros. in the '40s and '50s:

Maurice would do pencil drawings, little development color keys, and then he'd go through and do pencil layouts, which would go to Phil DeGuard and the other background painters to actually paint. So the BGs that you see in the *Looney Tunes* cartoons weren't Maurice's paintings, they were Phil's paintings—but they were Maurice's designs and they were Maurice's color. In terms of painting technique he would definitely contribute, "Use a sponge here; air-brush that . . ." although he was very against air-brushing unless it was a sky card¹ or something.

The relationship between layout and character design was also of paramount importance, although working with Warner Bros.' particular roster of stars brought considerable advantages, as Morse went on to explain:

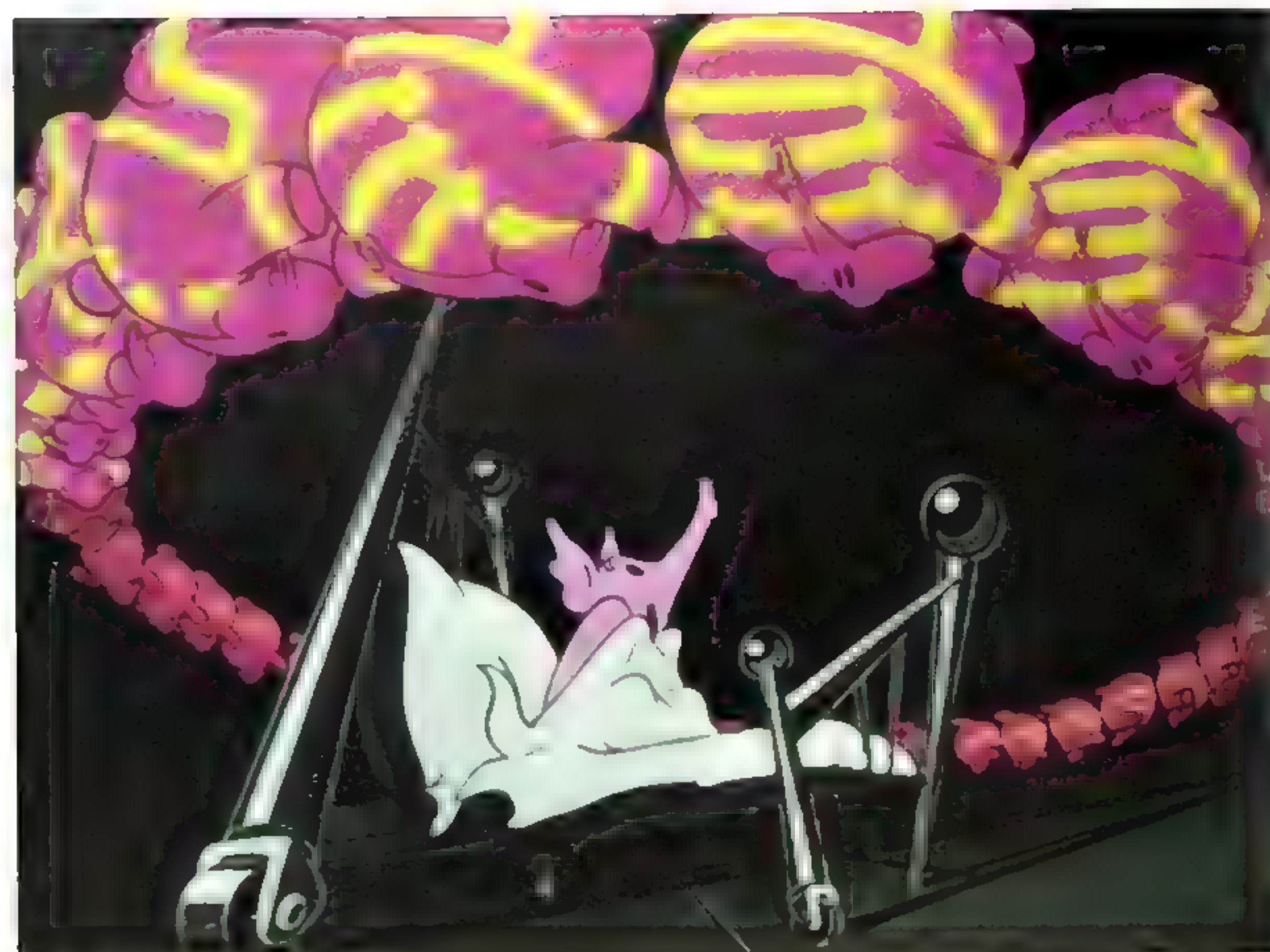
A big thing with Maurice, and one reason that he was able to go so crazy with the *Looney Tunes* backgrounds and the really dramatic layouts and color choices and the look of these films, is that the main characters were all basically blank characters. A lot of people don't realize that but, in design terms, Bugs is just a light gray character; Daffy is a black shape. So you had really basic character designs, which meant that their acting and their attitude were what was colorful about them. Nothing about them in design terms was obnoxiously "Look at me! Look at me!"—that was all in the performance.

Having experienced the benefits of learning from a first-generation animation designer like Maurice, all of the Noble Boys remain passionate about the need to communicate these same ideas and principles to future generations. Lou Romano in particular is well aware of the skepticism some

Though credited as a character designer on *Dumbo*, Maurice Noble also claimed credit for making the color choices in the film's "Pink Elephants on Parade" sequence.

Dumbo (1941)

Directed by Ben Sharpsteen



students have about the value and importance of the design territory beyond (and behind) the characters themselves:

Up to about 85 or 90 percent of our class, I felt, were there to go to Disney to do character animation. But I knew I didn't want to be a character animator. The rest of us were more interested in either story or design. There was really no animation at all in my student films, especially my first year film: it was very minimal, it was more about layout and composition. That really interested me because I felt, "This is filmmaking!"

For Scott Morse, while his own more recent career has been carved out in Story, he's in no doubt about one specific aspect of Noble's design legacy:

One of the main things I brought away from him, I think, was his use of color. Because they just didn't teach that in school! They don't teach it anywhere really. Nobody knows color!

Tod Polson remains keen to stress the distinction, as repeatedly expressed by Noble, between design for its own sake and design for a purpose:

Maurice said, "It's important to guide the eye and make the thing look good," but his criticism of some of the newer stuff was that you begin looking at the designs and the layouts rather than the characters, which is what you're supposed to be looking at. People think that if you make a building "wonky," that's stylization. And it's not at all.

With the cavalcade of complementary skills available to them under the one roof of Termite Terrace, Chuck Jones, Mike Maltese, and Maurice Noble developed an improvisational approach to the formulation of story, script, and visual design



that has had a powerful and lasting influence on animators throughout the industry, regardless of the specific animation format or medium they might be working in.

As Chris Wedge acknowledges:

You're always animating for a reason—and that's to stretch the boundaries of what we normally experience as the physics that bind us. Chuck is one of the people who had characters hang in the air longer, who took quicker takes, longer takes. He compresses and expands time and he exaggerates poses and extremes. There's obviously a lot that we drew from that legacy of his animation.

Jones's insistence on the potent immediacy of the hand-drawn character image was echoed by Noble's own complementary approach to background design. Both understood that on the occasions when everything really clicked, the movie itself would always become greater than the sum of its various component parts.

Respectful of one another's particular strengths and mindful of the peculiar magic inherent in each of the filmmaking disciplines, these delightful and eccentric artists infused their collective approach to short-format cartoon storytelling with a peculiar mix of determination and spontaneity that has

A familiar and powerful Warner Bros. prop, even without the cel overlay of the animating "big red switch."

Woolen Under Where (1963)

BG painting by Philip De Guard

Layout by Alex Ignatiev, design by Maurice Noble

Directed by Phil Monroe ■ Richard Thompson

ensured that character and location images from the *Looney Tunes* and *Merrie Melodies* still form an indelible part of the global animation vernacular more than half a century later.

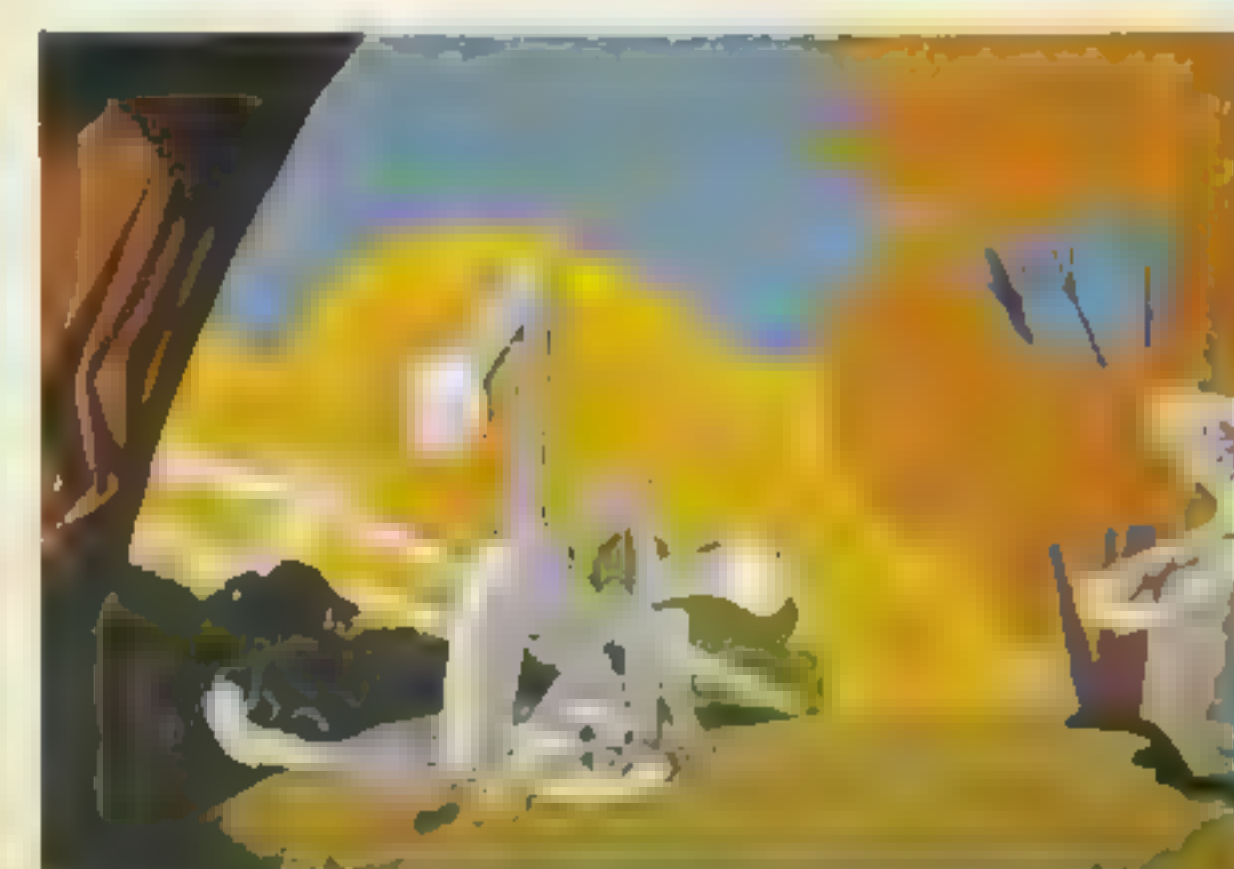
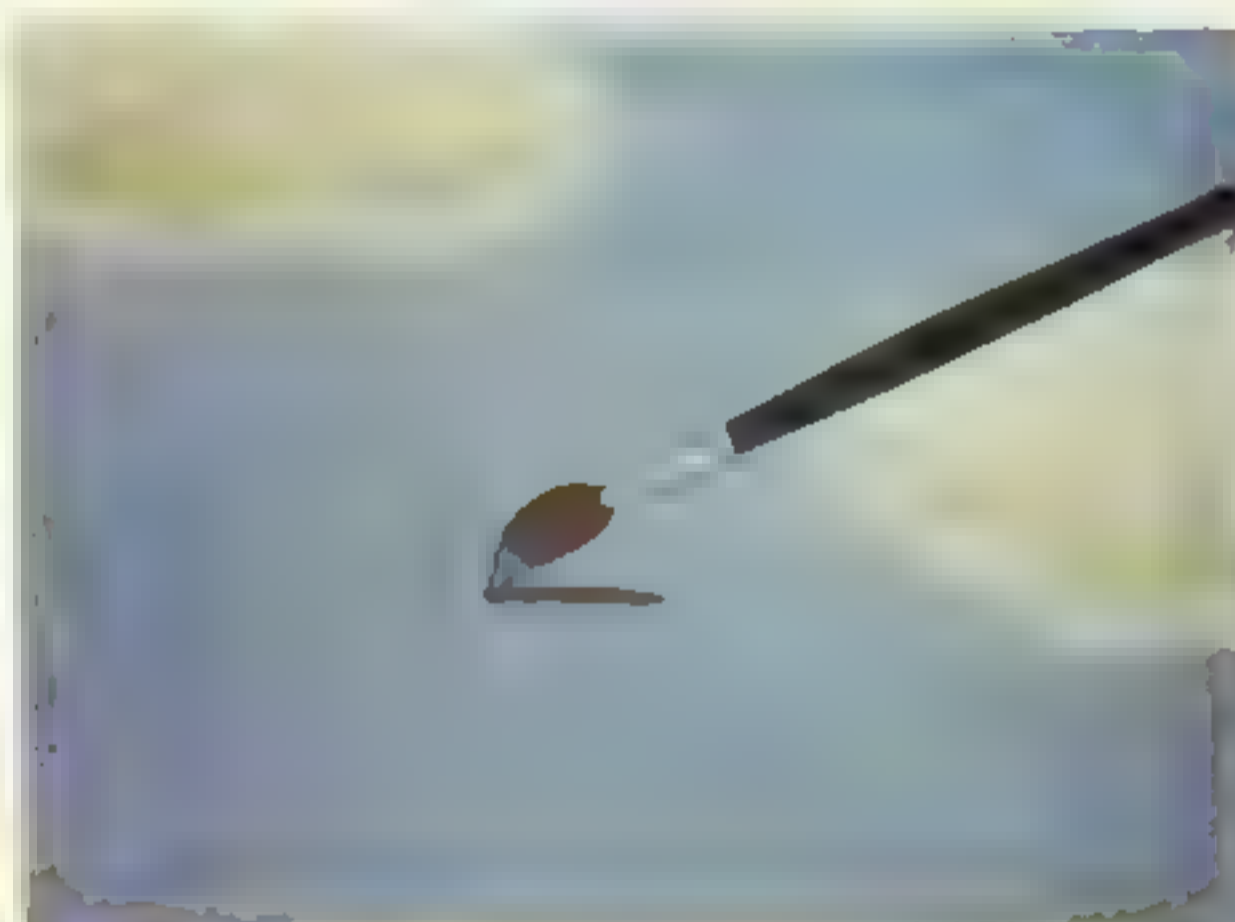
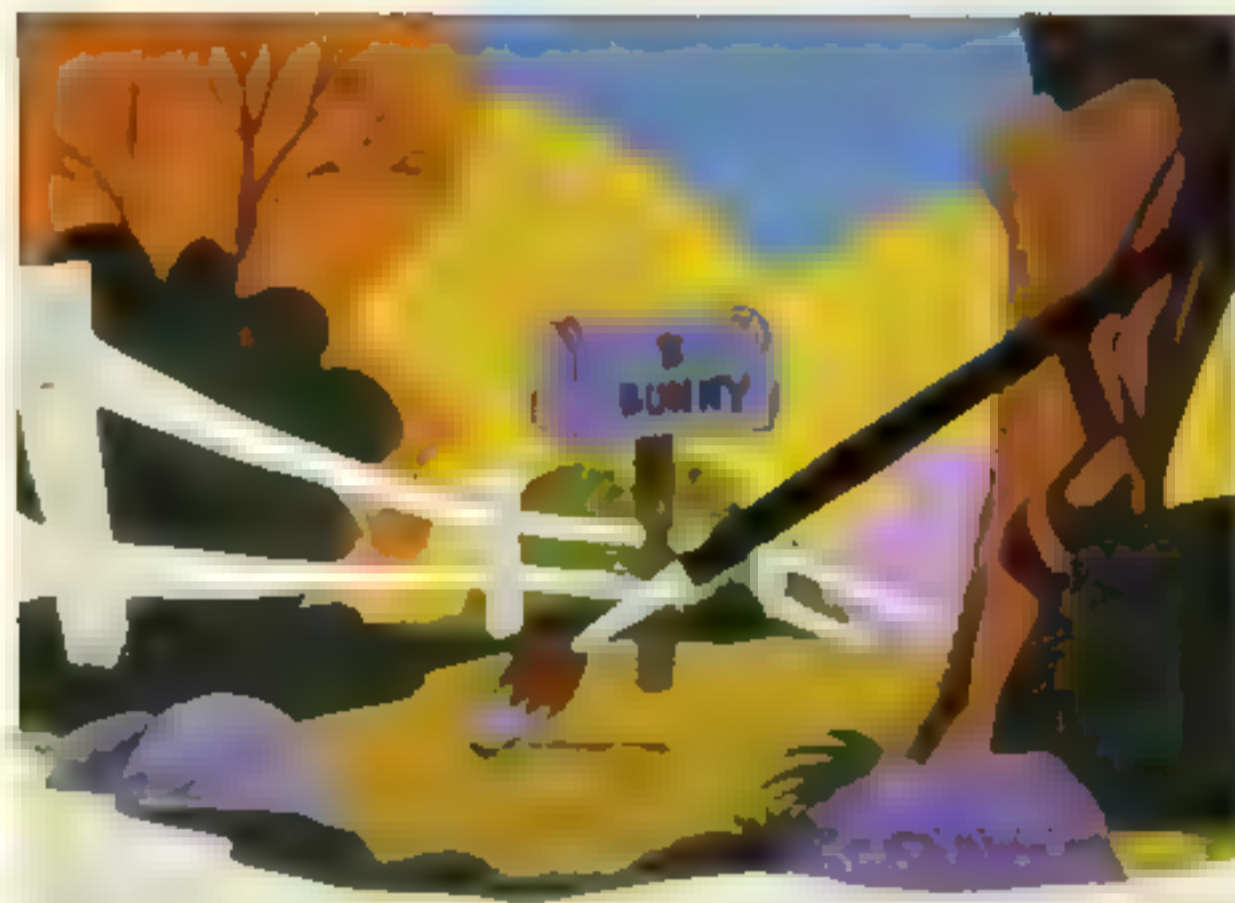
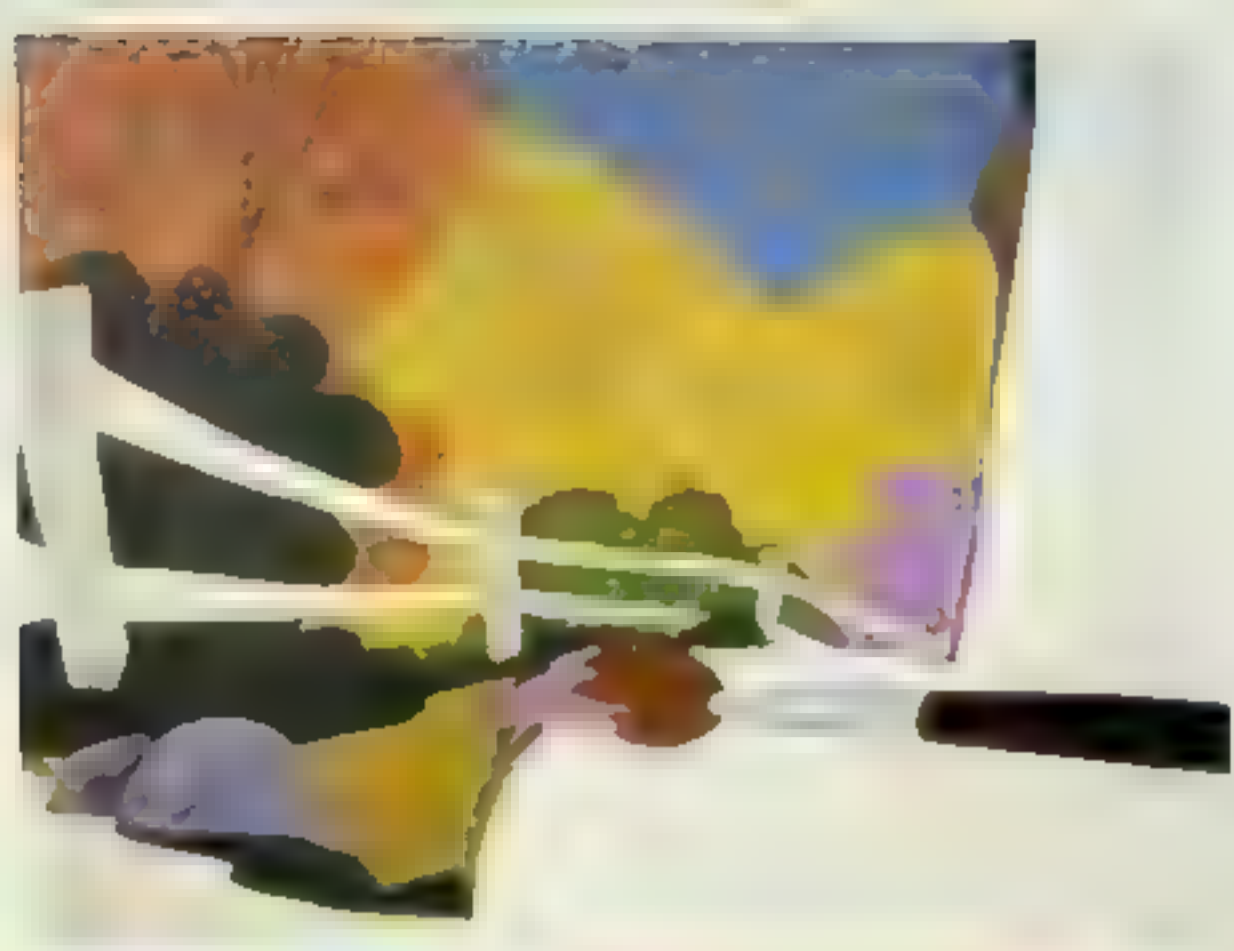
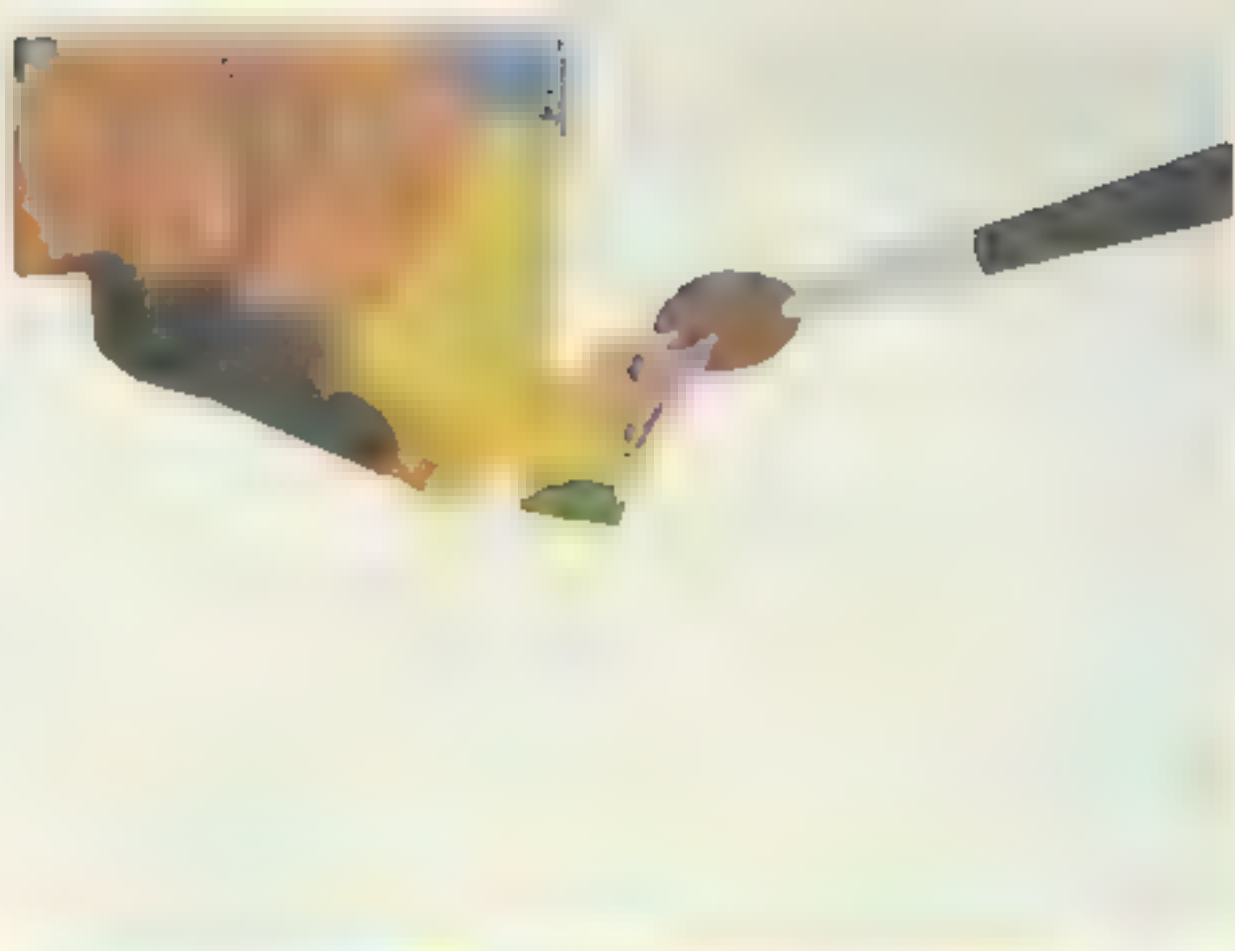
SHOWTIME FOR EVERYBODY

"Layout and Editorial go hand in hand. Story, Editorial, Layout—they all overlap in so many ways."
—John Musker, feature director, Walt Disney Animation Studios

How do you add time to a drawing?

The argument about two dimensions versus three dimensions has dominated so much of our thinking about animation in recent years that it's become all too easy to forget about the fourth dimension. Yet if, as they say, "it's all about timing," then we need to address the fundamental question of how time, this vital ingredient, is introduced to the process. Once again, this is something so obvious and familiar that it can be a hard idea to wrestle with at the conscious level, but it's one of the many essential yet invisible resources over which the Layout Department commonly has to gain and retain control.

Whatever material they're made of, be it real or virtual, the characters, the objects, and the cameras animators work with all need freedom to move left to right in the *x* axis, up and down in the *y* axis, and backward or forward in the *z* (depth) axis. But the movements they make within each of these first three dimensions have to be carefully controlled in terms of speed because the same simple movement can mean radically different things to us depending on how quickly or slowly we see it happening. One character's hand can connect with another character's face in a demonstration of affection if the movement is slow, while precisely the same gesture seems openly aggressive if executed at speed.

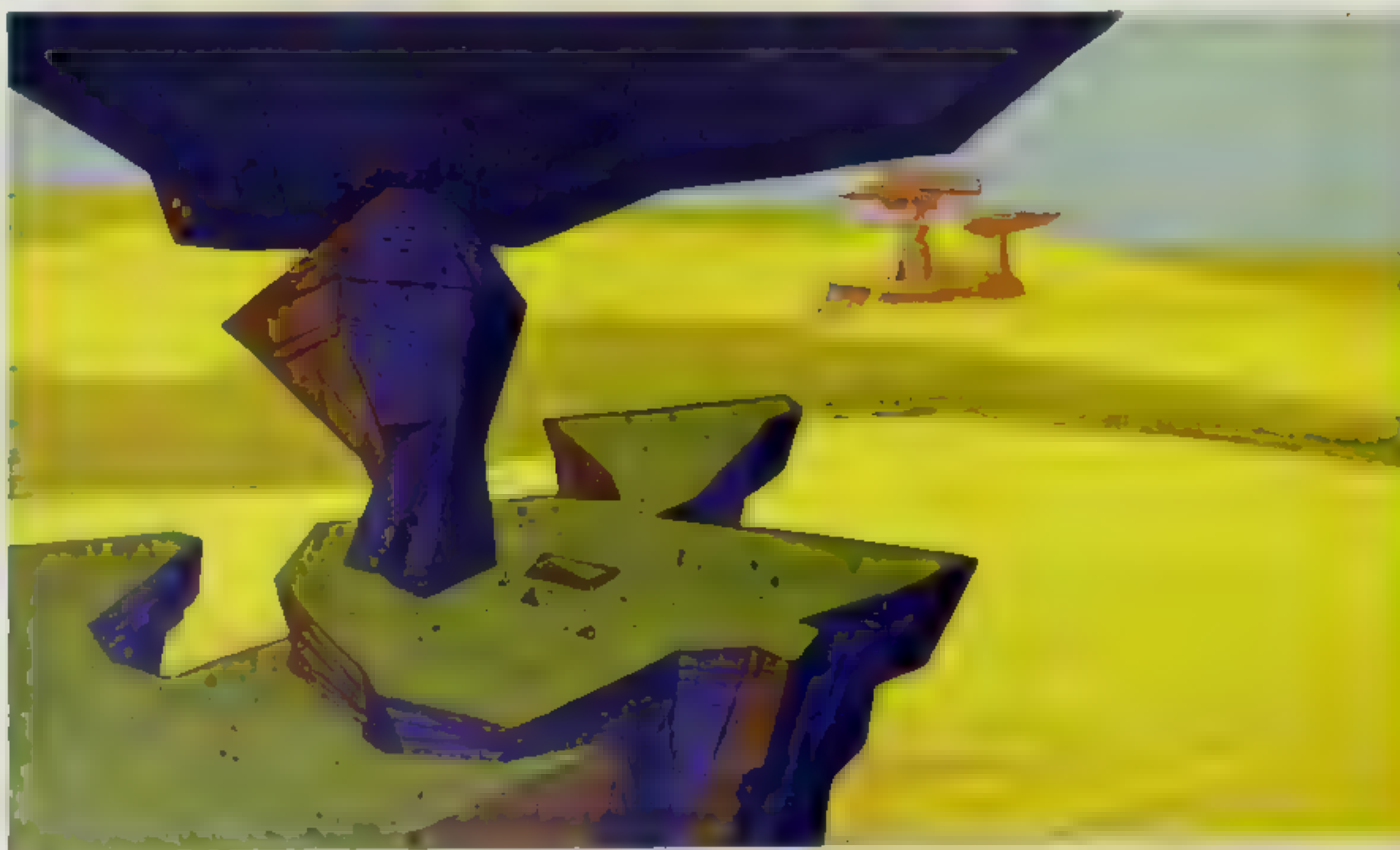
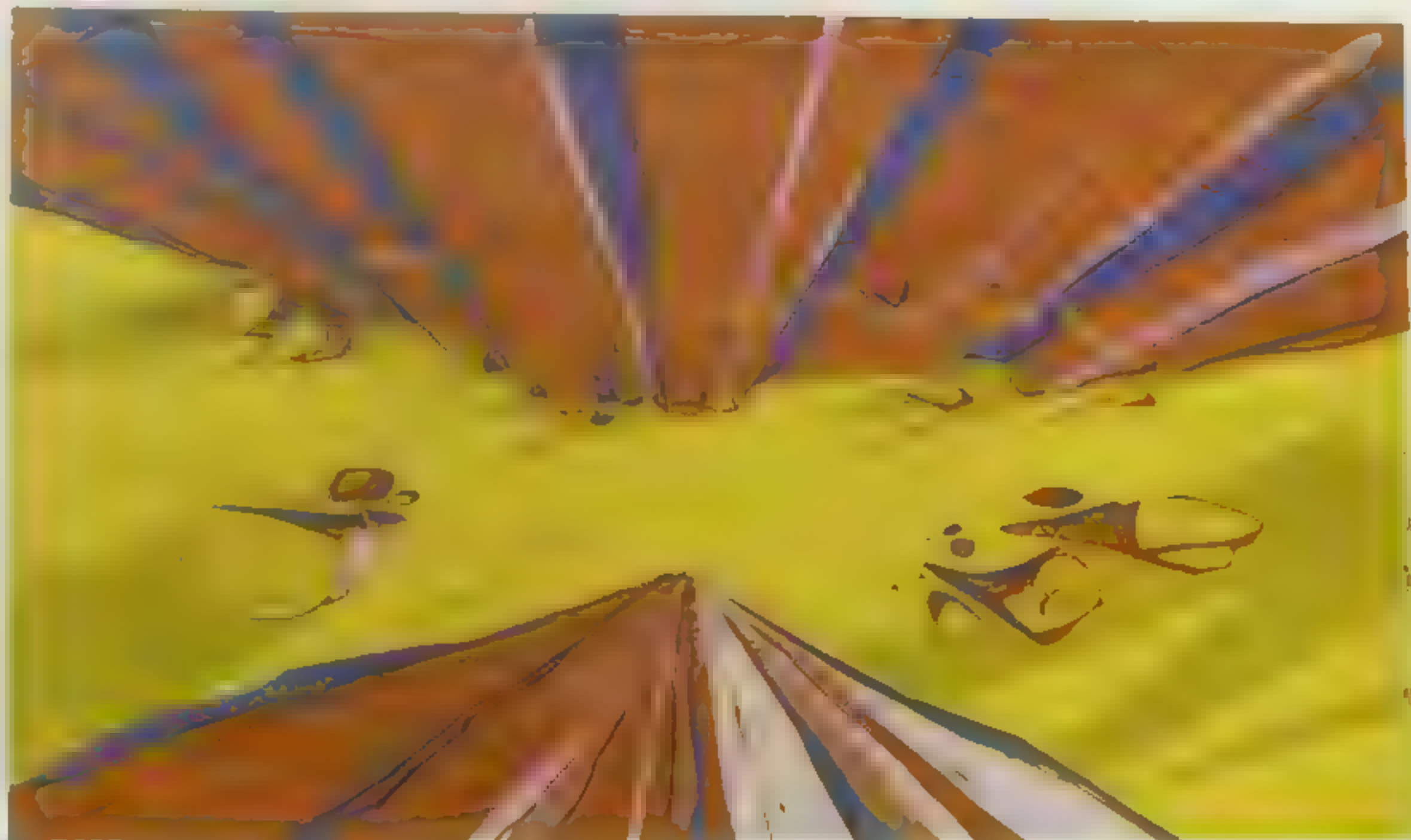


1930s. Frame enlargements showing the background artist's brush as it creates a regular cartoon landscape, instead of making his appearance, as usual, by burrowing up through the ground, in this shot Bugs Bunny is shown emerging from a rabbit hole between the painted clouds in the sky.

1930s. Ernest (Ernie) Nordli's layout designs seemed to encourage the background painter (in this instance, Philip De Guard) to work in bold areas of flat color with little or no attempt at realistic shading, it was a stylistic approach that became increasingly successful and influential as TV became the dominant medium for viewing cartoons.



1930s. Yet another attempt, in which the Coyote will inevitably plummet, while the Road Runner enjoys the freedom of an endlessly ribboned horizon.



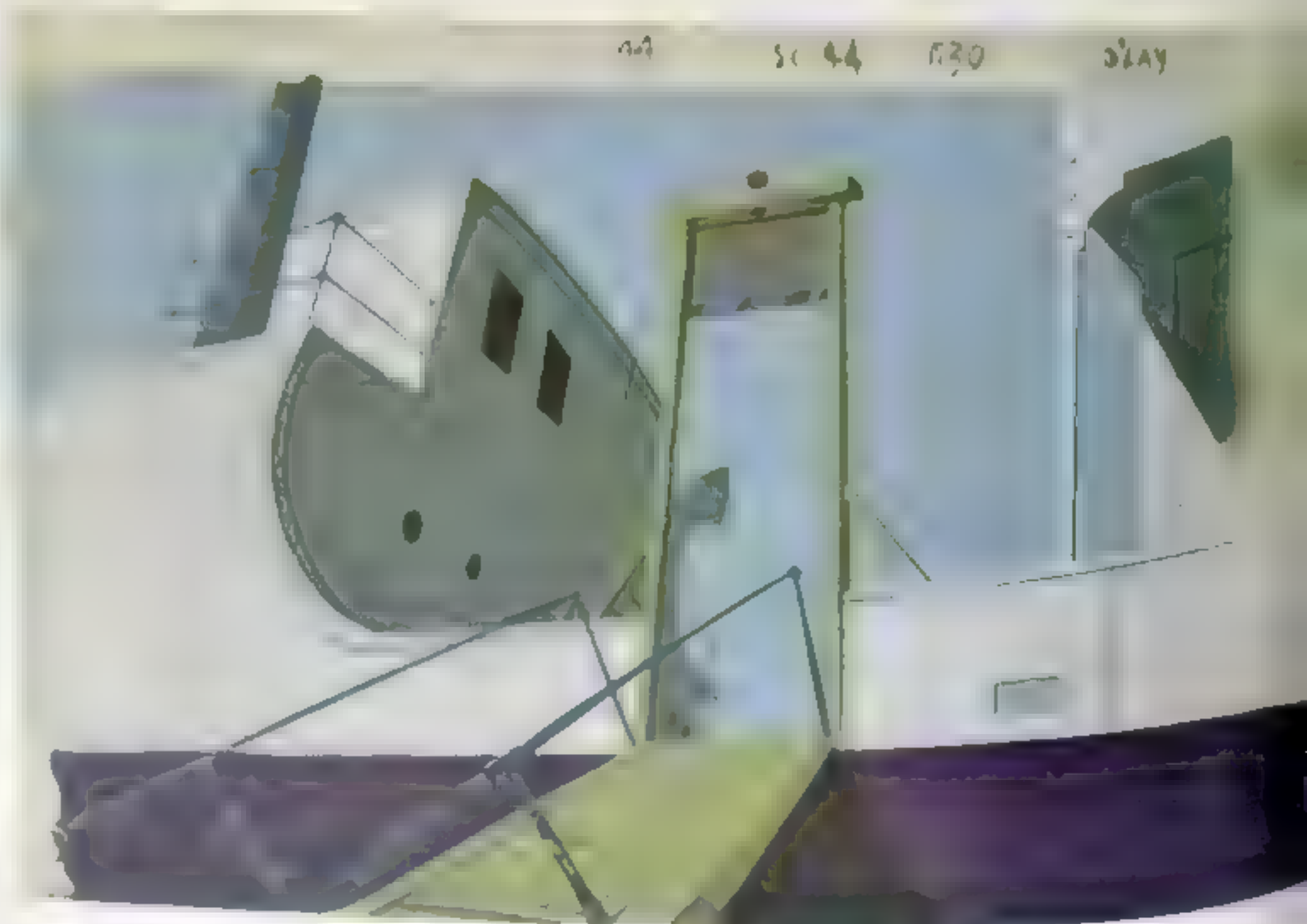
Heightened perspective and strong diagonal compositions are used in these Sylvester and Speedy Gonzales backgrounds to help emphasize the contrast in scale between the cat in charge of the gigantic ship and the tiny mice who have to survive a booby-trapped gangplank in order to get on board and reach the cheese stored in the hold.

Movie: *Sylvester the Cat* (1940)

Movie: *Speedy Gonzales* (1946)

Character: *Speedy Gonzales*

Created by: *Walt Disney*



PHOTOGRAPH: Birns & Sawyer stopwatch used by animator, story writer, and director Irv Spector for timing scenes and specific animated "gags."

Different techniques are employed to compress or expand time in both literature and theater, but we sometimes forget that prior to the invention of cinema, no such distortion as time lapse or slow motion existed in ordinary human pictorial experience outside of the dreaming state.

It's also possible to talk in subjective, even poetic terms about our personal experience of time being variable. Depending on our emotional state we can feel as though time is either slowing down or accelerating, and different physical activities can have a similar impact on our perceptions. Before movies existed, however, musicians and composers were perhaps the only artists who, with the aid of rhythm and tempo, had anything like the same ability to manipulate an audience.



RIGHT In *Robots* (2005) the action has to move from cozy domestic interiors to gigantic cityscapes while the characters have to read clearly against complex lighting setups that can switch in a moment from broad daylight to the glow of an industrial furnace.

According to Rob Cardone, "In this sequence Rodney starts up at the highest point of Robot City where everything is shiny and polished and then he crashes into a billboard and bounces down through the different stages of the 'Robots' world—which we set up like a class system. The upper class occupies the highest level in the

This is something that moviemakers, and animation designers in particular, need to keep in mind, as Pixar art director Ralph Eggleston was eager to make clear:

I always laugh at comments where they say, "Well, it was manipulative. The film was overly manipulative." I'm like, "That's the POINT!"

Of course, in dramatic terms, when you're storyboarding an animated sequence, the question really ought to be not, "How do you add time to a drawing?" but "How much time do you add between two or more drawings?" A live-action camera captures movement happening in real time; animators have to create every movement from scratch and decide the timeframe within which each should occur. In budgetary and scheduling terms, further down the production pipeline, an animation crew also needs to ask, "How much time is available for each department to produce the artwork that's required of it?" because time, in that sense, is money.

STORY REELS

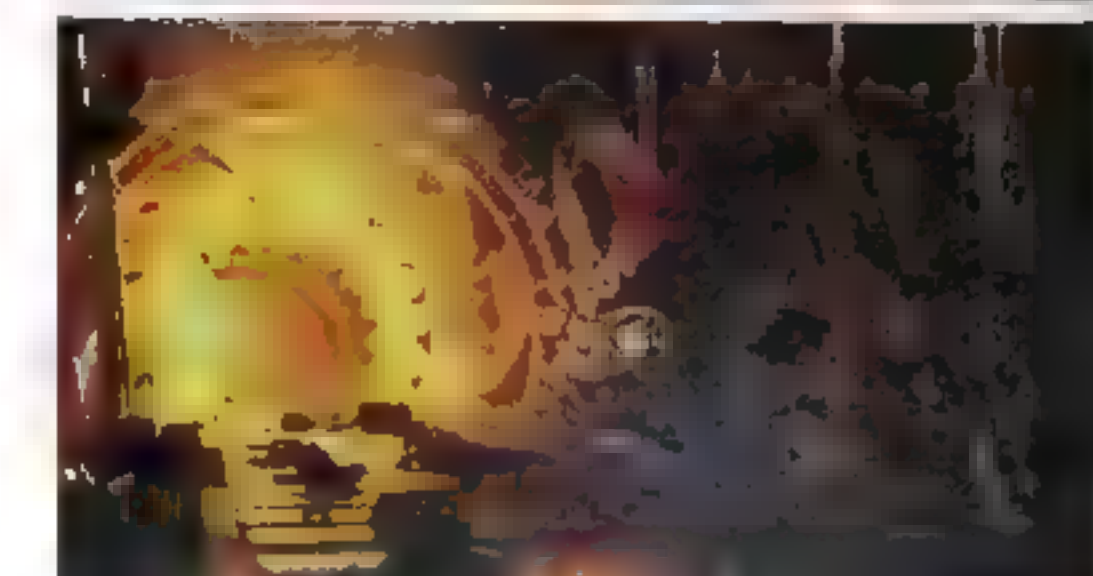
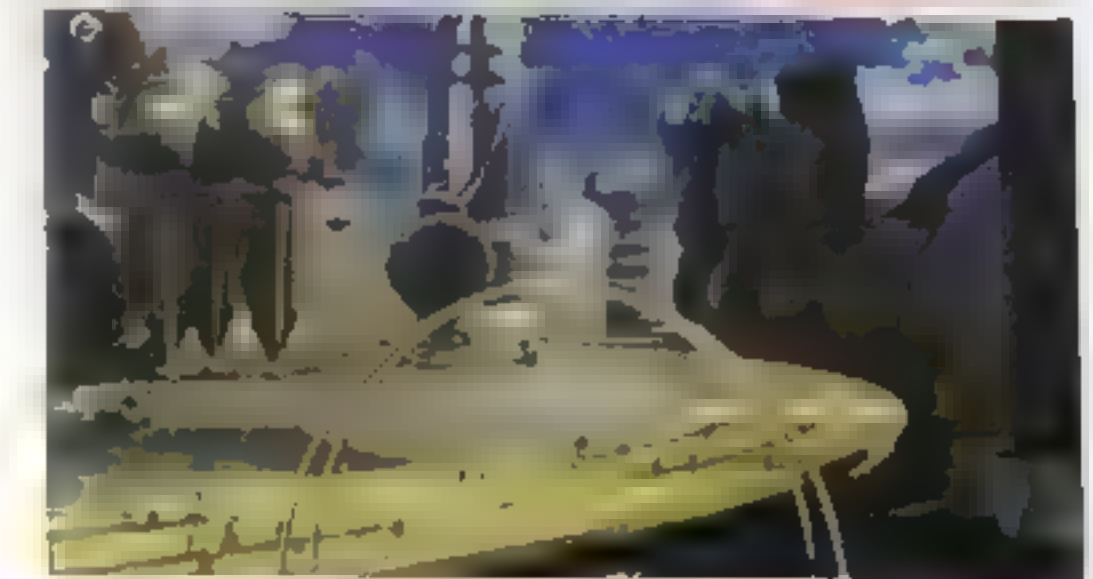
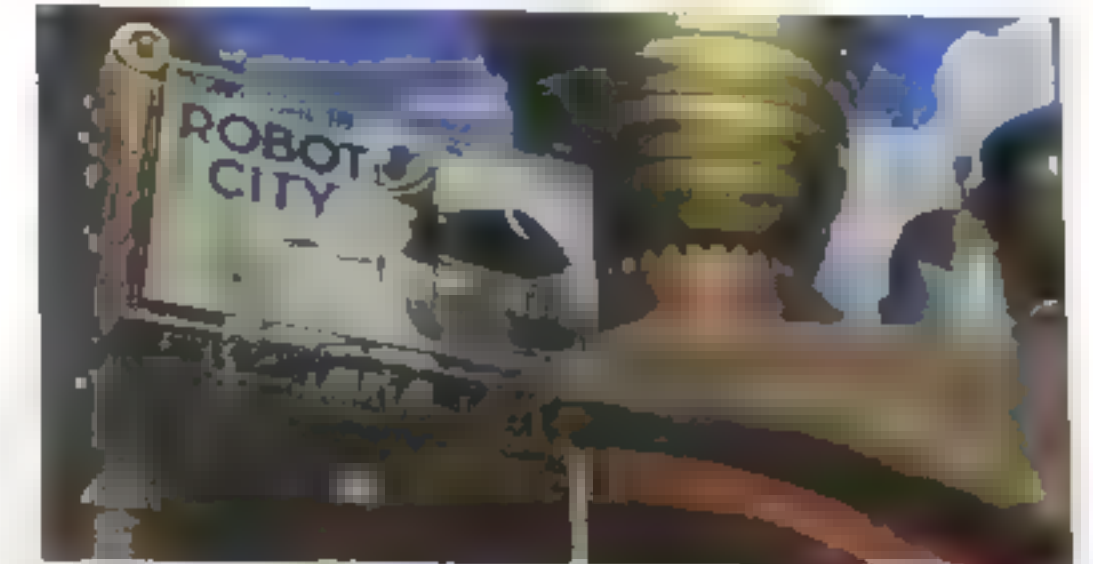
Whether you're working in 2D or 3D, dramatic time first enters the moviemaking equation within the feature animation process when a story artist "pitches" a storyboard to a room full of people. But, as with any live performance, the speed of an individual's delivery can easily be at variance with the material. Nothing definitive is possible in terms of timing movements or pacing scenes until the story sketches are unpinned from the 'board and either photographed or scanned to be handed over to Editorial.

Once in the editor's hands, this raw material begins to exist in story reel (or pose reel or Leica reel) form as a filmed (or digitized) rough sequence that everybody can see replayed in real time

environment and then, as he's bouncing down through the lower depths to the bowels of the city, it's more rusty and dirty and grimy and you see the changing of the world and the introduction of the street sweepers. Then, when he finally lands at the bottom, he's basically in a junkyard."

Frame enlargements from *Robots* (2005)

Directed by Chris Wedge and Carlos Saklatvala



With the same seven-minute running time as a Warner Bros. *Looney Tune* or an MGM *Tom and Jerry*, and with most of the action taking place within one kitchen interior, it was possible for Blue Sky Studios to produce the computer-animated short, *Bunny* (1998) without any one artist or department taking sole responsibility for layout.

Bunny (1998)

Directed by Chris Wedge

according to the measurements of the clock. Later, as the rough artwork travels further downstream to the various production departments, each second of on-screen time will be divided into the 24 smaller units which represent the individual frames of film and the various items of artwork that need to fill those frames.

WHERE THE RUBBER HITS THE ROAD

While sharing many of the techniques common to commercials, TV series, and animated shorts, Layout and Editorial have to play a greatly expanded role in the production of an animated feature. While readily comparable to the smaller scale Leica reels that act as the template for many 30-second advertisements, story reels for a full-length movie become the center of a complex planning operation, the scale of which Chris Wedge

discovered when Blue Sky Studios, the CG animation company he cofounded, made the transition to movie production:

In the old days when we were making commercials or short sequences in animation, one person would be doing more of the work, so you didn't have to communicate with other people as much. You would draw the storyboards, you'd sell the client on the concept, you'd model it and animate it. We only got to the point where we had to specialize when our company grew.

We had never had an Art Department at Blue Sky before *Ice Age* came along; we'd never considered having a separate Layout Department either. It just became an issue of managing and maintaining the concept, from the script to the 'boards and then to layout, which is where all of the work entered the computer domain.

At that point our story crew was fairly small and we were mostly drawing for character and for comedy. But when we got to layout, that's where we started thinking more about camera, so there was quite a bit of back and forth in order to preserve the tone and the intent of each shot but also to discover it in 3D.

On *Ice Age* Layout really was the department where the rubber hit the road. Partially it was the scale of the project and the specificity of what we were trying to do from scene to scene, because we were doing traditional story panels and pinning them to storyboards, then scanning them in and cutting story reels.

While dealing with the same underlying principles of filmmaking and design as their counterparts in traditional animation, CG directors like



Chris Wedge and the layout artists they work with are involved in the construction of a “solid” world of 3-dimensional digital geometry, so many of these artists leave no paper trail.

By contrast, on a movie like Disney’s *The Princess and the Frog*, the hand-animated feature that film editor Jeff Draheim was working on when I interviewed him in 2009, the layout artists with whom he was conducting a regular dialogue were not only contributing rough sketches for inclusion in the story reels for the movie, they would ultimately still be generating all their final, cleaned-up layout drawings in pencil on paper. As John Musker, co-director of the movie, explained:

It’s a weird thing. They had initially tried on this film to do the animation completely paperlessly, and I know that had been the dream years ago, like, “Let’s do it all with no pencils, no paper . . .” but there were issues in terms of software and resources. In terms of the drawing surface I think the manufacturers of the graphics tablets have gotten feedback saying, “Can you make this less like a piece of glass and more like a piece of paper?” But I don’t think they’ve arrived at it yet. I think it will move more in that direction, but there is still something about the tactile quality of pencil on paper. It’s amazingly hard to duplicate such a simple thing.

With this in mind, it’s important, at the editorial stage in particular, to recognize that in CG and traditional feature animation, two quite different definitions of “layout” exist (even though the ultimate goal and the underlying principles and tool-kits may be shared). In a CG studio like Pixar, the production designer and concept artists may create sketches and paintings in preproduction that suggest how a certain set might look and even how it might be furnished or lit. But the construction of

all the environments themselves ultimately takes place in the virtual 3-dimensional realm within the computer, along with the execution of the required camera movements.

ALL THIS FLEXIBILITY

Having started his career in the live-action cutting room, Disney film editor Jeff Draheim also appreciates the peculiar creative freedom that this stage in the feature animation process allows. He clearly relishes the active (and productive) communication that opens up between Story, Layout, and Editorial at this important stage:

It took a little bit of getting used to, because working in the live-action world it’s pretty much, “OK, here’s all the footage we shot, this is what you have to work with, now: Go!”; it took me a while to embrace the idea that in animation it’s like, “OK, the story artists have worked up their ideas . . .” and so on. But there’s all this flexibility.

When you’re putting the story reels together it’s all just evolving, and sometimes I’ll look at something and say, “Well, I see what you’re doing but what if, here, we went to this shot first and then cut to the wide? And then back to the 2-shot?” and then even before it’s turned over to me, they’ll quickly swap all that around. Even after the fact you can go back two weeks later and say, “Hey, you know what? I need a wide shot to go in here instead. Could you quick-draw one up for me?” and I’ll get it within five minutes. I’ve got to say—that’s one thing I really enjoy. And that doesn’t work in live-action. At least it would be very expensive if you tried it.

Even when a storyboard has been created in preproduction on a live-action movie, camera and editing choices may ultimately be dictated by outside factors during the filming process. Lee

Unkrich, film editor on *Toy Story* and now a director at Pixar, shares Jeff Draheim’s background in live-action film editing. His own prior experience helped get around any notion of a storyboard having to remain “sacred”:

You know, there are myriad decisions to be made at any given moment in a film, about how you want the audience to feel and what you’re trying to communicate. These are just basic things for a director in live-action. You’re thinking about how to best use your camera to provide the foundation for the story that you’re telling and that wasn’t happening so much. People were just kind of mirroring what was being drawn in the storyboards, and very early on I started to ask John Lasseter, “Do we necessarily *have* to film this the way it is in the storyboards? Or can we . . . ? There are a million choices to be made here!”

Not having made the intermediate step of working in hand-drawn animation before arriving at Pixar, Unkrich was at first unaware of the role that Layout could play in making those choices and solving the kinds of problems that become apparent in Editorial. Several years on and numerous productions later, he’s in no doubt about the importance of CG layout as it has developed at Pixar:

Because I hadn’t worked in animation I had no idea what layout even was in 2D. For me it was about the fundamentals of storytelling, where are you putting your camera? How are you moving the camera to help with your storytelling? What kind of lens are you putting on the camera? People always talk about the director/editor relationship and how you need to just be so simpatico and, at least in our world, I now find that I need to have that same relationship with the person whom I’m doing layout with.

In the pre-digital era, story reels for an animated feature were created by photographing each of the rough story sketches on 35mm film and then splicing them together in the cutting room according to the shot (or scene) timings set by the director(s) and the film editor. With the advent of digital editing software a far greater degree of sophistication and freedom has become possible at this early stage while handwritten exposure sheets have largely been replaced by on-screen displays, charts and diagrams.

When a sequence of original, rough story drawings makes the transition from page to screen in the form of a story reel, issues other than timing and performance can become apparent, particularly with regard to camera placement, as Unkrich discovered:

The story reel is great for working out pacing issues and business and acting and just the structure of the film as a whole. But when it comes down to deciding where you're going to put the camera and how you're going to film the scene, there are any number of choices to be made.

The animators need to know exactly why they've got two characters in a shot rather than three. A million decisions need to be made and the layout lead, the director, and the editor need to be working in tandem so that you're all on the same page about exactly what you're trying to achieve. Otherwise you're just wasting people's time.

The animators need to have this very set "box" because by the time it gets to the animators it's so expensive and time-consuming that they need to know exactly what they need to achieve in that shot; there's not room for loose experimentation and trying. "Well maybe we can do this . . . and maybe we could . . . ?!" so it's got to be what it is.

PUTTING SOME REAL STUFF IN THE GROUND

Early in the production when it's still safe to be experimenting, this open dialogue between Story, Layout, and Editorial allows all the different possibilities to be explored, but it is creativity with a very clear purpose. As individual sequences begin to be approved into production, this continued communication helps Unkrich and the team to rule out any weaker ideas, thereby securing a firm foundation for the film:

I love having that part be messy and malleable and, "Oh, well, what if we try this . . .?! Give me another version of this camera; I may not use it but let's do it!" I like going a little nuts when I'm in layout and having all these raw materials out on the table so that we can shape it and really get everything just so. But again, when it comes time to lock that, when I'm happy with the scene and we've fine-tuned the hell out of it, I need to be completely confident that this is now ready to go downstream. Because this is it! It's showtime! For everybody.

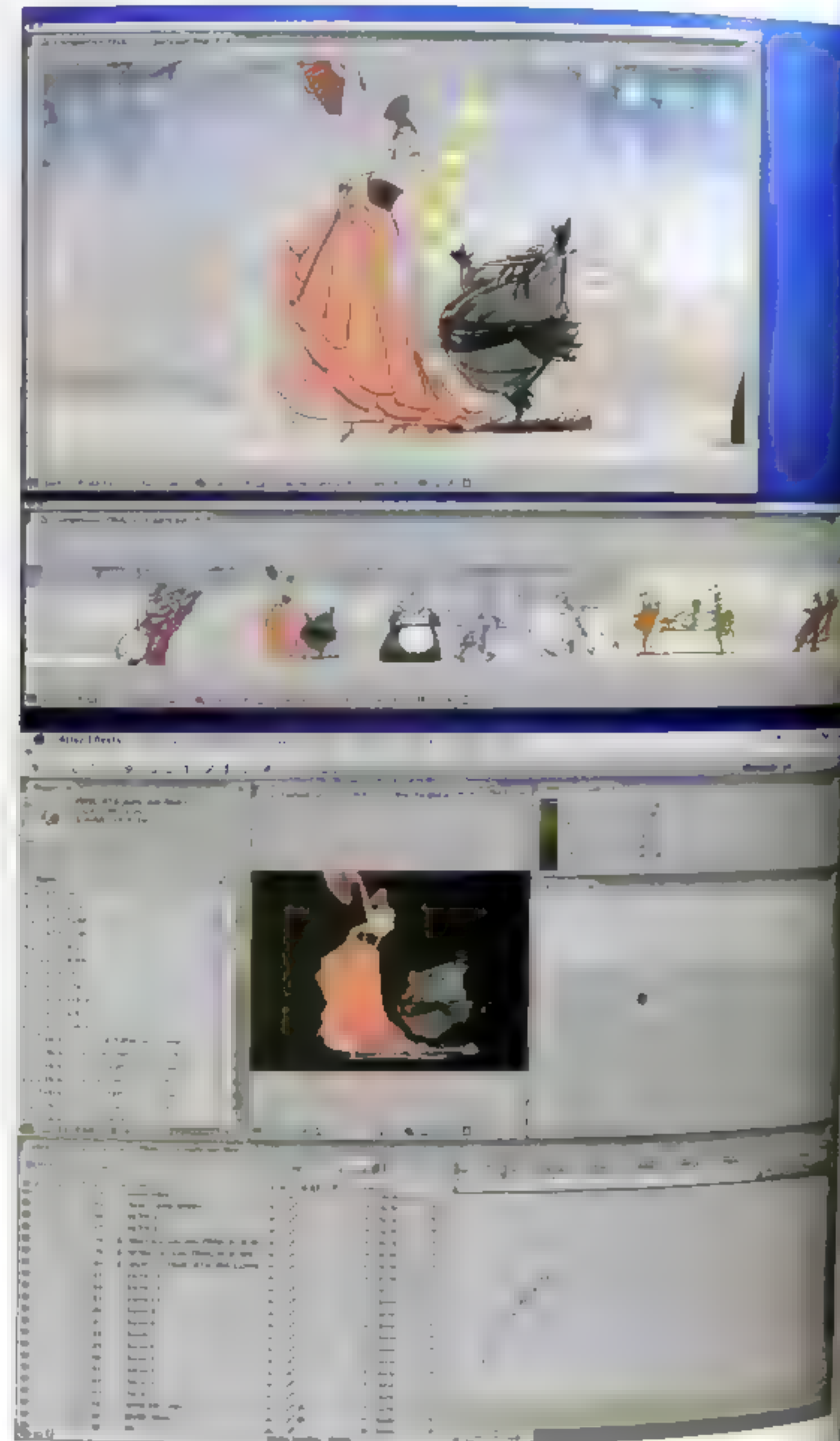
I visualize layout in my head almost like the center of an hourglass: before you get to layout, everything is very malleable, the story can be changed, you can rewrite, you can redraw, a lot of things can change. But when you get to layout, it's the first time that you're putting some real stuff in the ground.

THE WORKBOOK: "A COMIC BOOK KIND OF THING"

In the late 1980s production of hand-drawn features at Disney turned a corner into the digital age with the design and implementation of the CAPS system. By the time I joined the crew of *Tarzan* at the end of the '90s, a range of systems and methods had evolved at the studio, including a procedural step called the *workbook*, which owed as much to the slow percolation of ideas hatched in the 1950s as it did to the new technology. As Disney director John Musker explained:

At Disney, storyboarding wasn't designed to be a shot-for-shot thing. Sometimes the filmmaking was there in the 'boards but a lot of times they went for the entertainment and the idea and the attitude, so you still had to really work out the filmmaking aspects like, "How long is a scene?"

Screen grabs showing the Editor's work-in-progress on the "Masquerade Ball" sequence
The Princess and the Frog (2009)
Directed by Ron Clements and John Musker
Storyboard artist Kevin Gollaher



In this original story sketch from *Toy Story*, Buzz is shown in the leading position, eyes forward, with Woody being carried along underneath, staring excitedly at the ground below. In the completed movie the relationship between the figures has been subtly altered, by placing Woody ahead of Buzz and fixing both characters' eyes on the road ahead, the duo becomes much more of a "team."

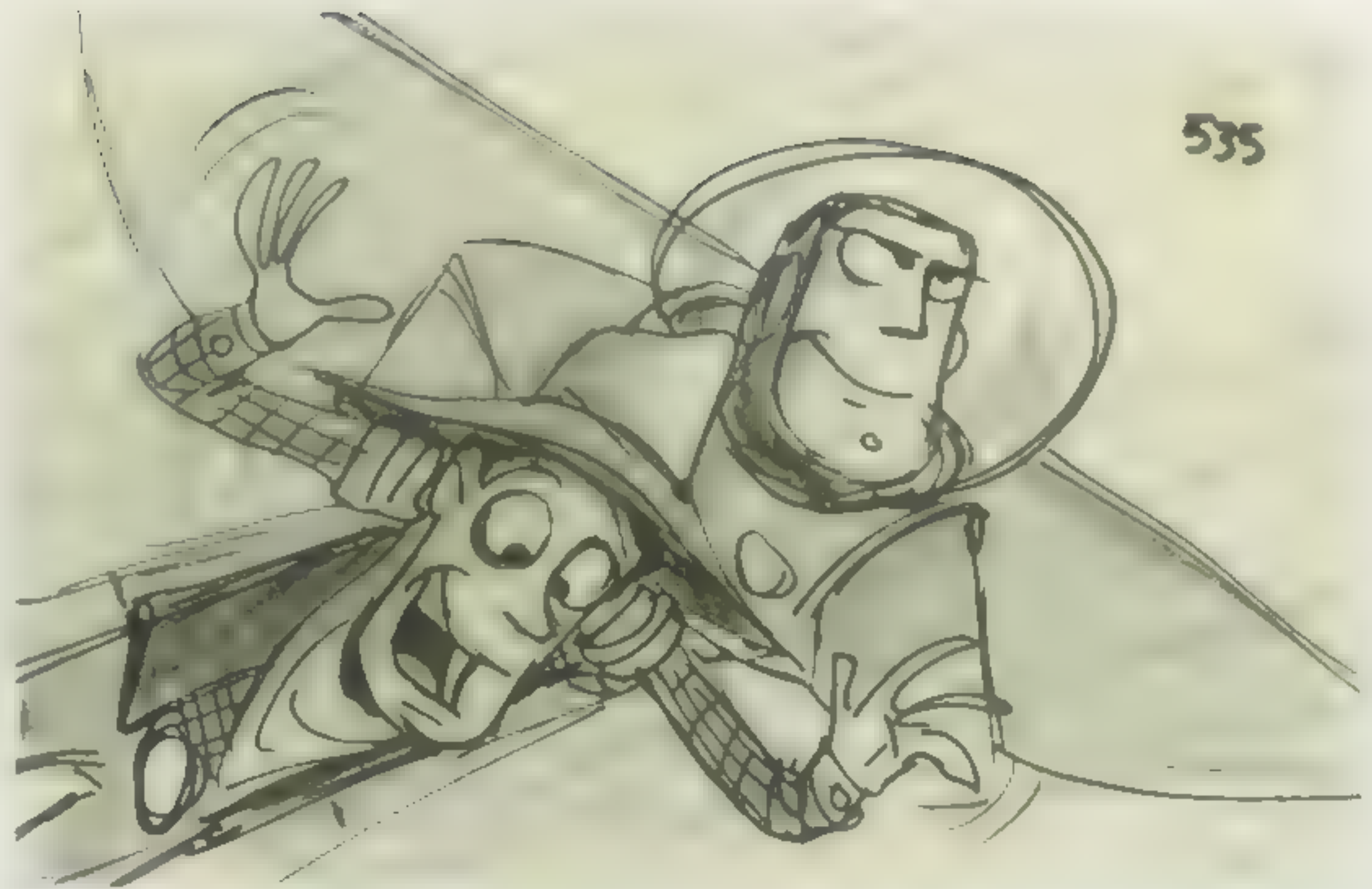
"When do you cut?" "What angle are you showing this from?" and all that sort of thing.

Our grounding was the Ken O'Connor approach. At CalArts he showed us his workbooks from *Peter Pan*, where he created thumbnails of staging ideas, and he showed us how he organized a Disney "board" with his thumbnail layouts. So, on *Little Mermaid* when Dave Dunnet was our head of layout, we were going for workbooks that really blocked out the cutting

Bill Perkins, who joined the layout team at Disney in 1986, described how a suggestion made by Director George Scribner on *Oliver & Company* helped reignite wider interest in this important intermediate step that helped in the transition between the storyboard and the story reel:

Very few of us on the layout crew for *Oliver* had any long-term experience, except for Dan Hansen who was head of layout at the time; during production George Scribner said, "Boy, I'd really like to have a comic book kind of thing that we could use, so I could see the movie before we make the movie!"

So they called Ken O'Connor in, and George tossed the "comic book" idea out to him and Ken came back with something that was like what we would now think of as a workbook; I could see it was immediately useful for the sequence we were working on. But the story went into a rewrite so that prototype workbook sat around in the Layout Department for a while. But it was an idea whose time was due and we did a little bit of workbook on *Mouse Detective*, but it was never fully part of the production, it was just individuals like me chiming in on, "Hey! This would be a good idea!"



Anyway, the next film was *Little Mermaid* and one day I walked by the Xerox machine and the art director was copying a couple of pages of something, and I said, “What is that?” and he said, “Well these were some drawings that Ken O’Connor did years ago on *Cinderella* . . .”

There’s one particular sequence where *Cinderella* comes in after she’s fed the animals and Lucifer the cat has a teacup and he’s trying to catch one of the mice without being discovered by Cinderella. I had done some research on *Cinderella* myself, and if you look at the storyboards for that moment then look at Ken O’Connor’s drawings and compare the two, you can see how he’s created a “staging pass.” It wasn’t an official “gag pass,” because they did that in story. What Ken did was he took the storyboard and he combined some of the scenes, adding notes for what the camera might do and basically, cinematically expressing what the ‘boards had indicated but demonstrating how to do it in a manner that flowed more with the story, ■ manner that was quicker, simpler—direct.

STRICTLY CINEMATIC

The “speed and simplicity” of the workbook method may well have contributed to the “messy and malleable” approach that Lee Unkrich was to find so helpful and productive a part of the editorial process in CG animation a decade later. Perkins went on to describe the “lock-in” sessions that became part of the routine for himself, Dan Hansen, and Rasoul Azadani at a point when the digital tide had risen only so far:

On *Rescuers Down Under* we transitioned from using a traditional 35mm down-shooter with the platen glass, the top and bottom pegs and so on, to using the CAPS system. Dan Hansen was head of layout, Rasoul Azadani and I were leads and that

was the first production where we really utilized a workbook.

Hendel Butoy and Mike Gabriel were both advocates of the workbook approach, so on each sequence Dan and Rasoul and I would get locked in a room with the director and the storyboards and we’d review the reels and then we would start sketching. Then we’d stick all of those sketches on the ‘board and they really wouldn’t let us out of the office until the sequence was done because everybody felt strongly that that was a great way to work.

The original story sketches were all laid out and all the scenes would be numbered during those sessions. At that point, the scene cuts were only where the storyboard artists had placed them, so these meetings allowed us to talk specifically about the cinematic aspect of the sequence. We might combine scenes, we might see if some visual components were becoming redundant; then we’d compress or drop things out. But it was strictly from the cinematic point of view because the storyboards already contained all the performance necessary for the animators and there was no need to redo any of that.

FOOTAGES FOR A NEW CUT

While it has been possible for CG animation to move ever closer to the live-action model in recent years, in hand-drawn animation it has always been essential to establish the precise length, in seconds and frames, of each scene before it is allowed to proceed into Animation, and it is at this point in the editorial process that these figures need to be established, as Perkins again explains:

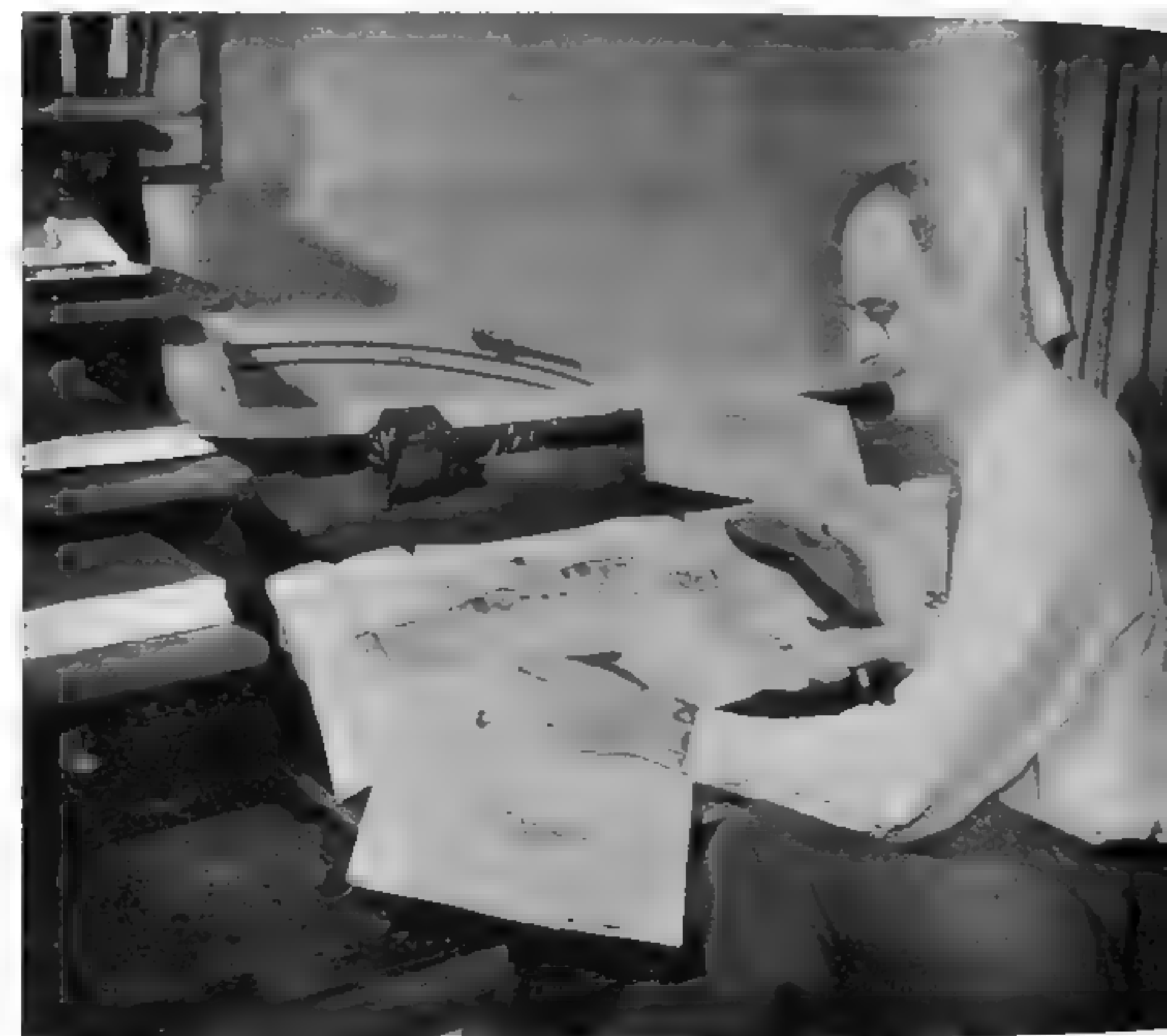
Dan would take notes while all this was going on, then he would go back to the editor, who had all

BELOW: Ken O’Connor adding clean-up detail to a panning background layout with a completed character cell overlaid for reference.

The Whale Who Wanted to Sing at the Met

Walt Disney Productions (1946)

Directed by Clyde Geronimi and Hamilton Luske

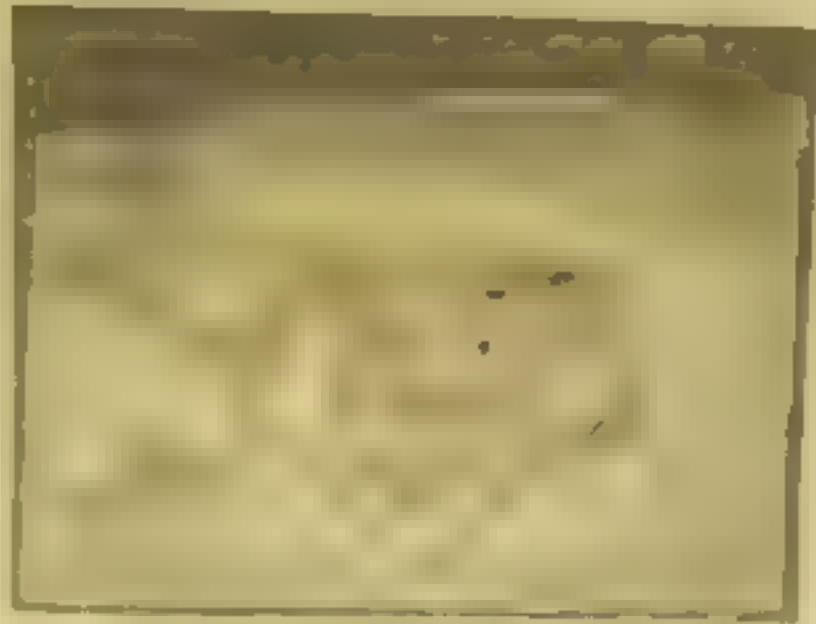
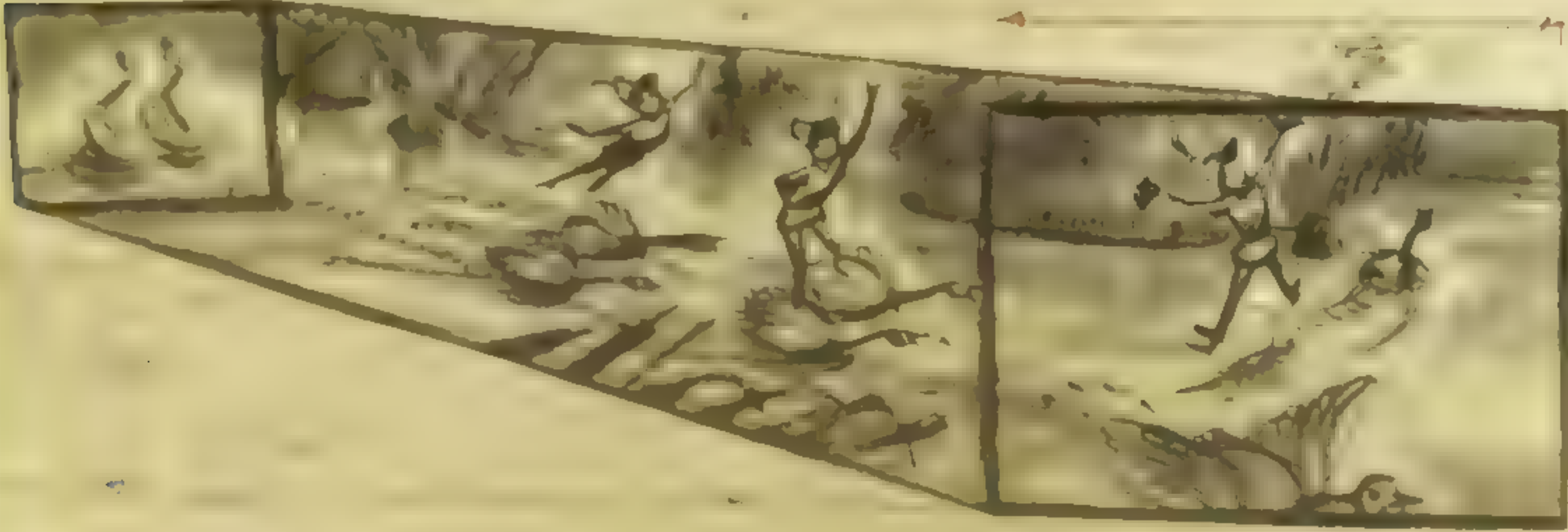
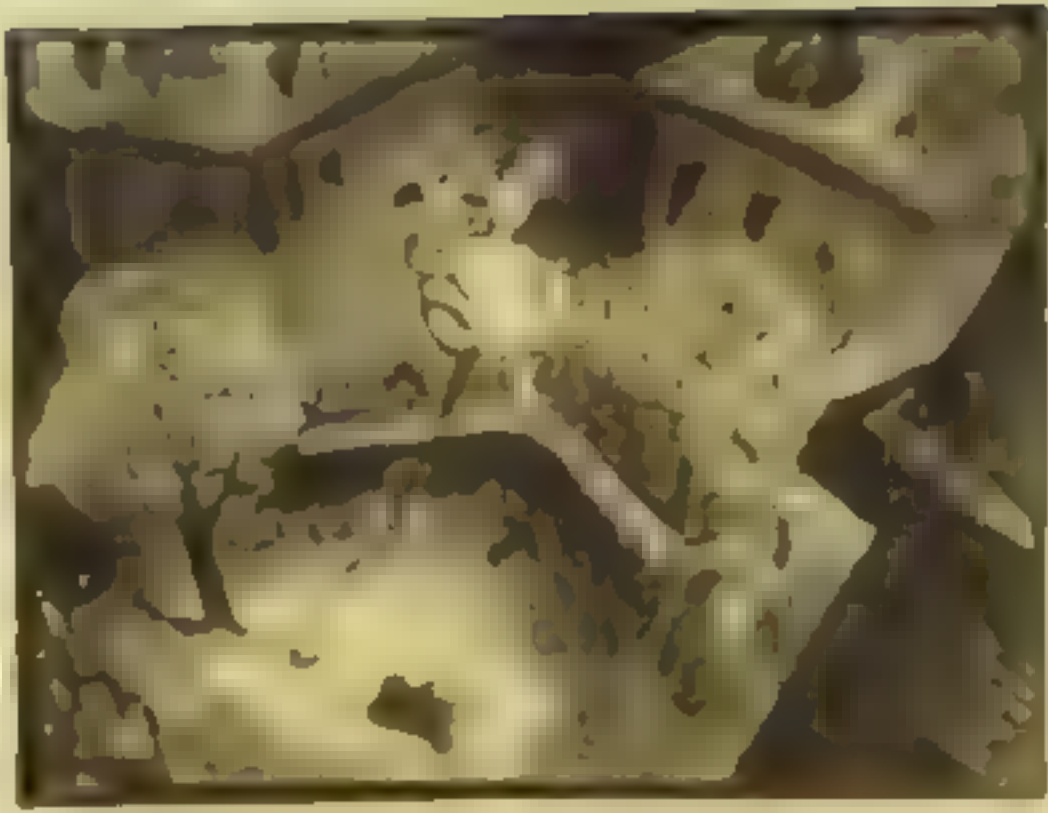
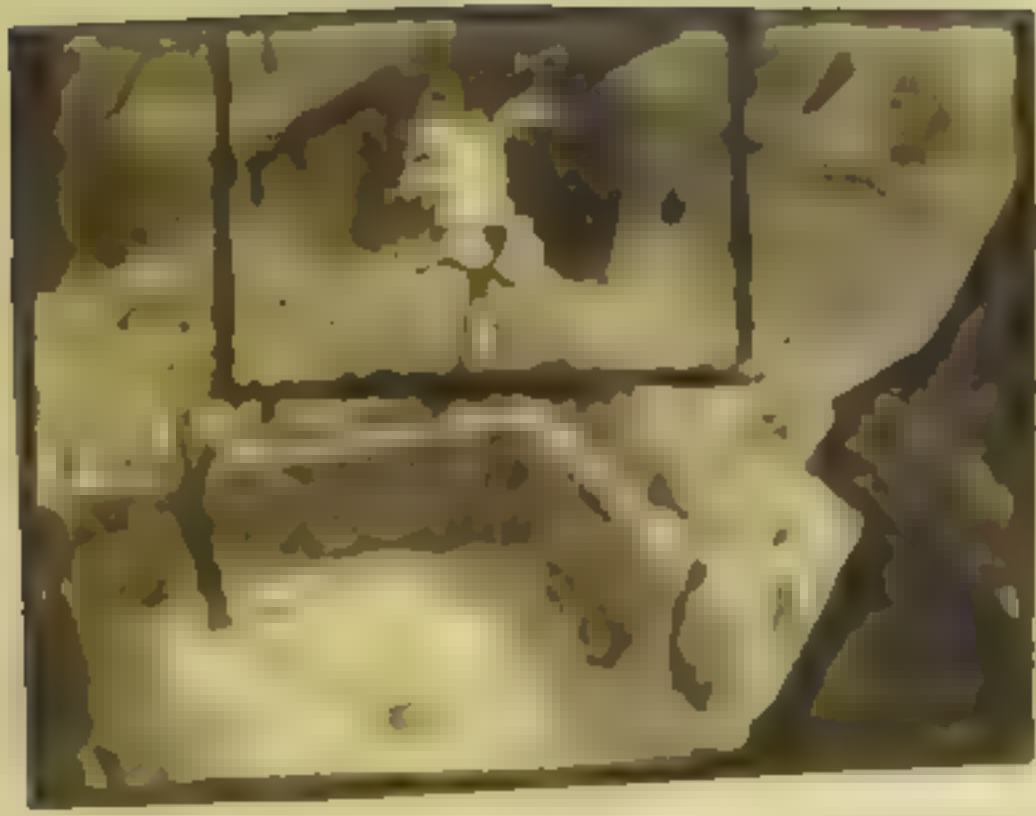


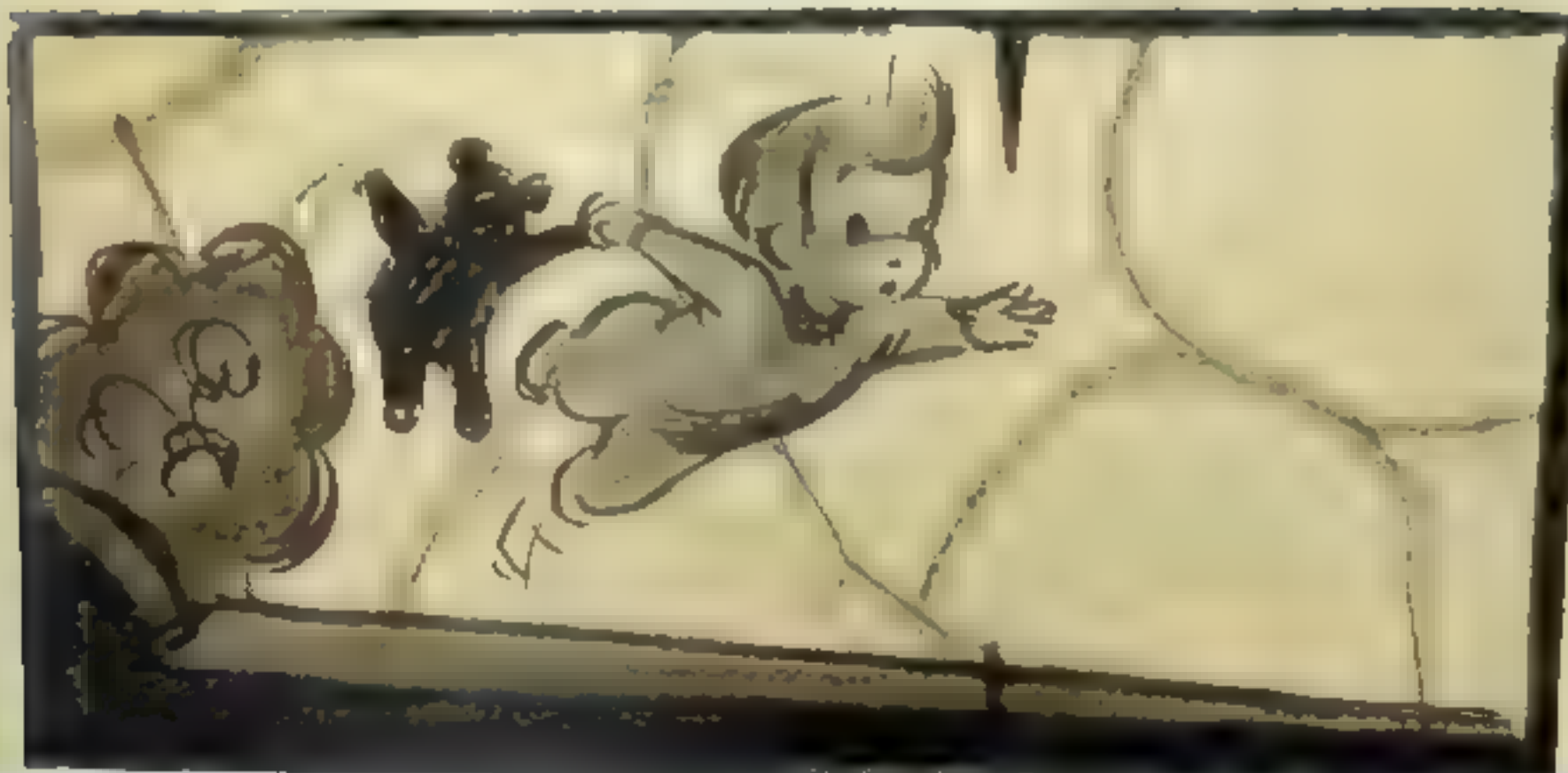
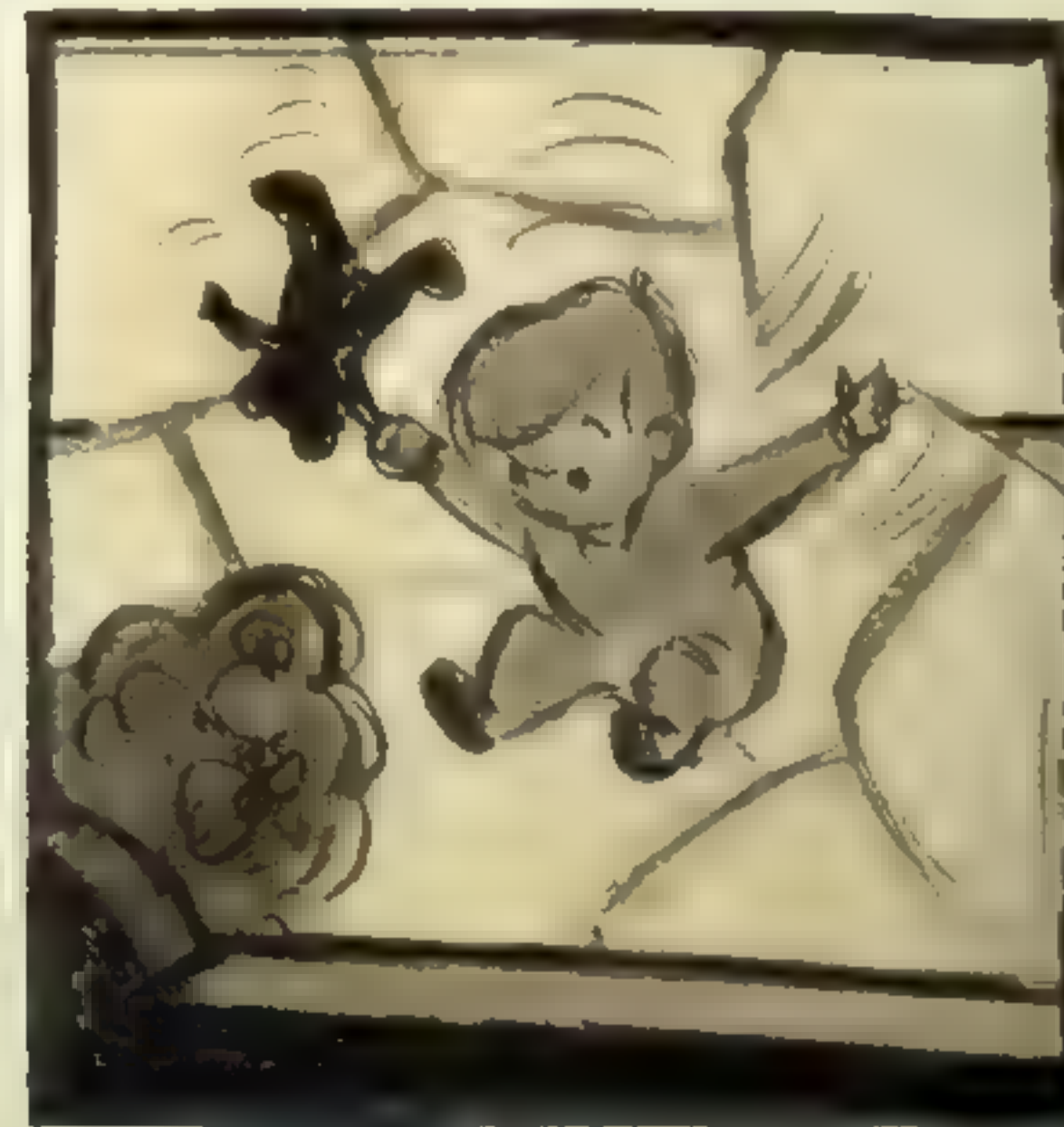
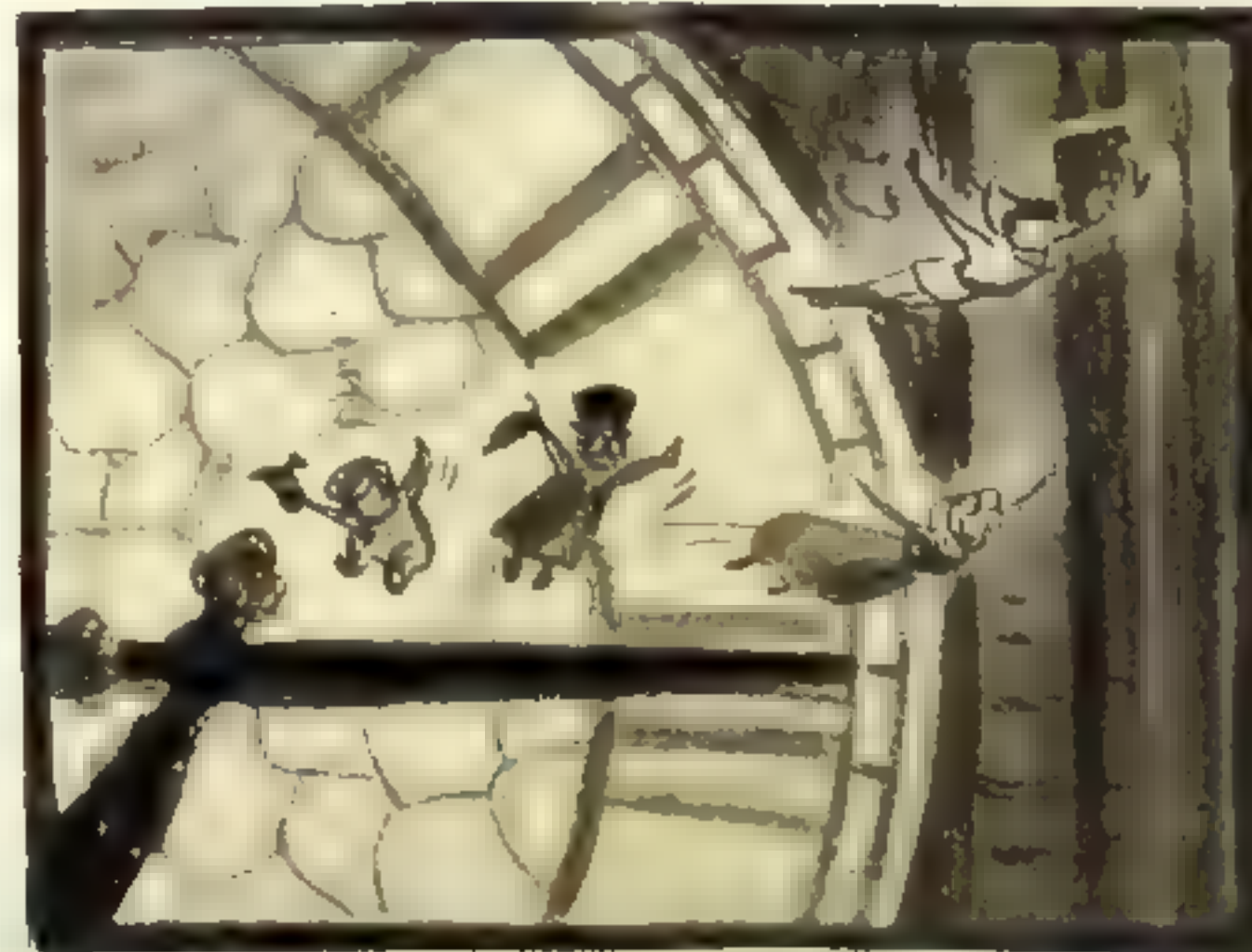
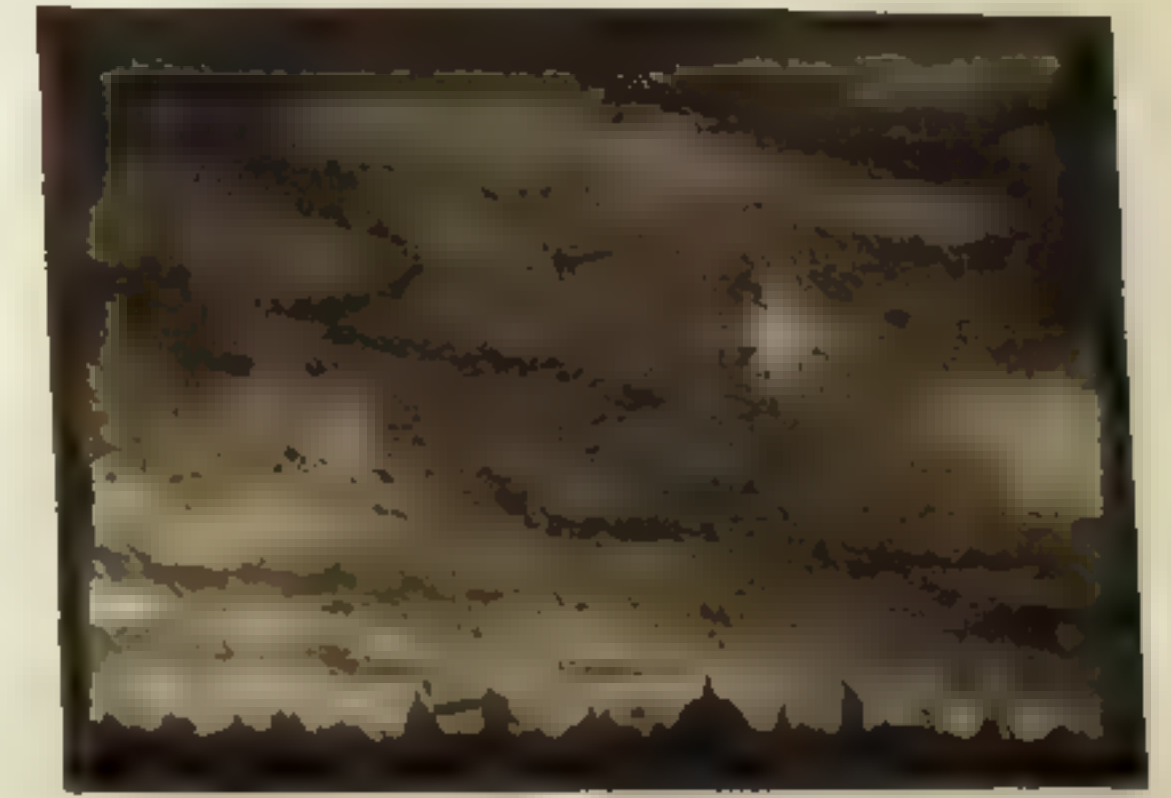
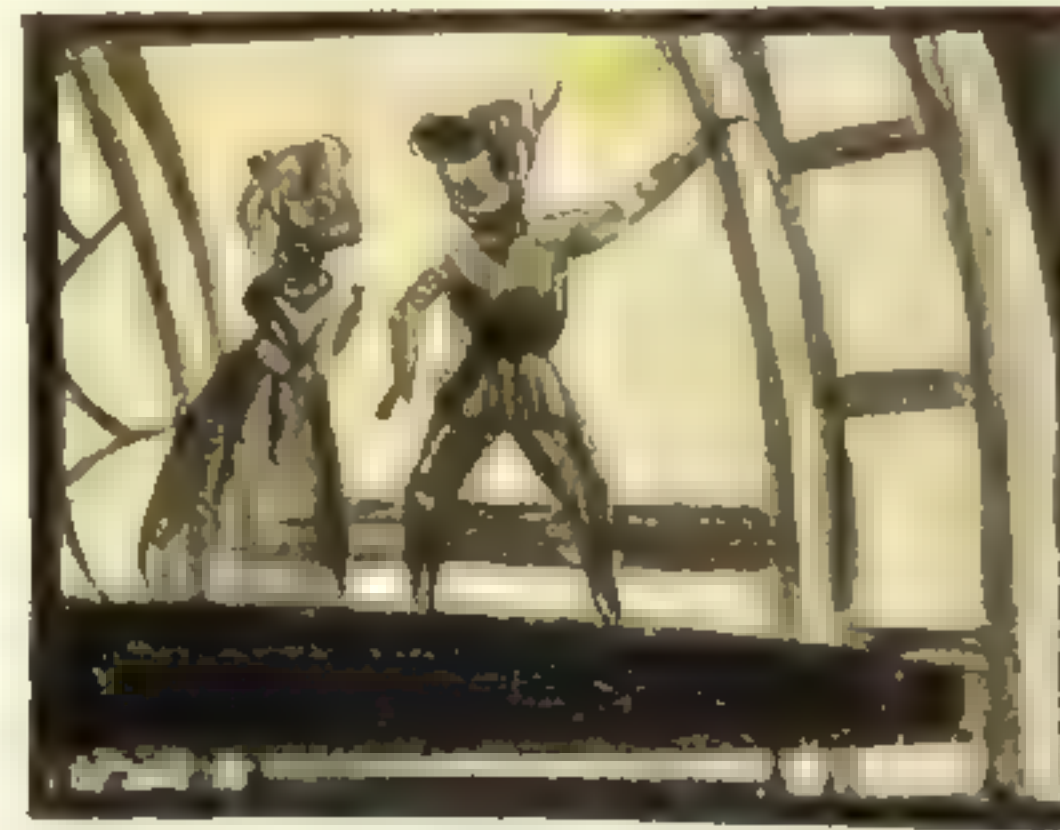
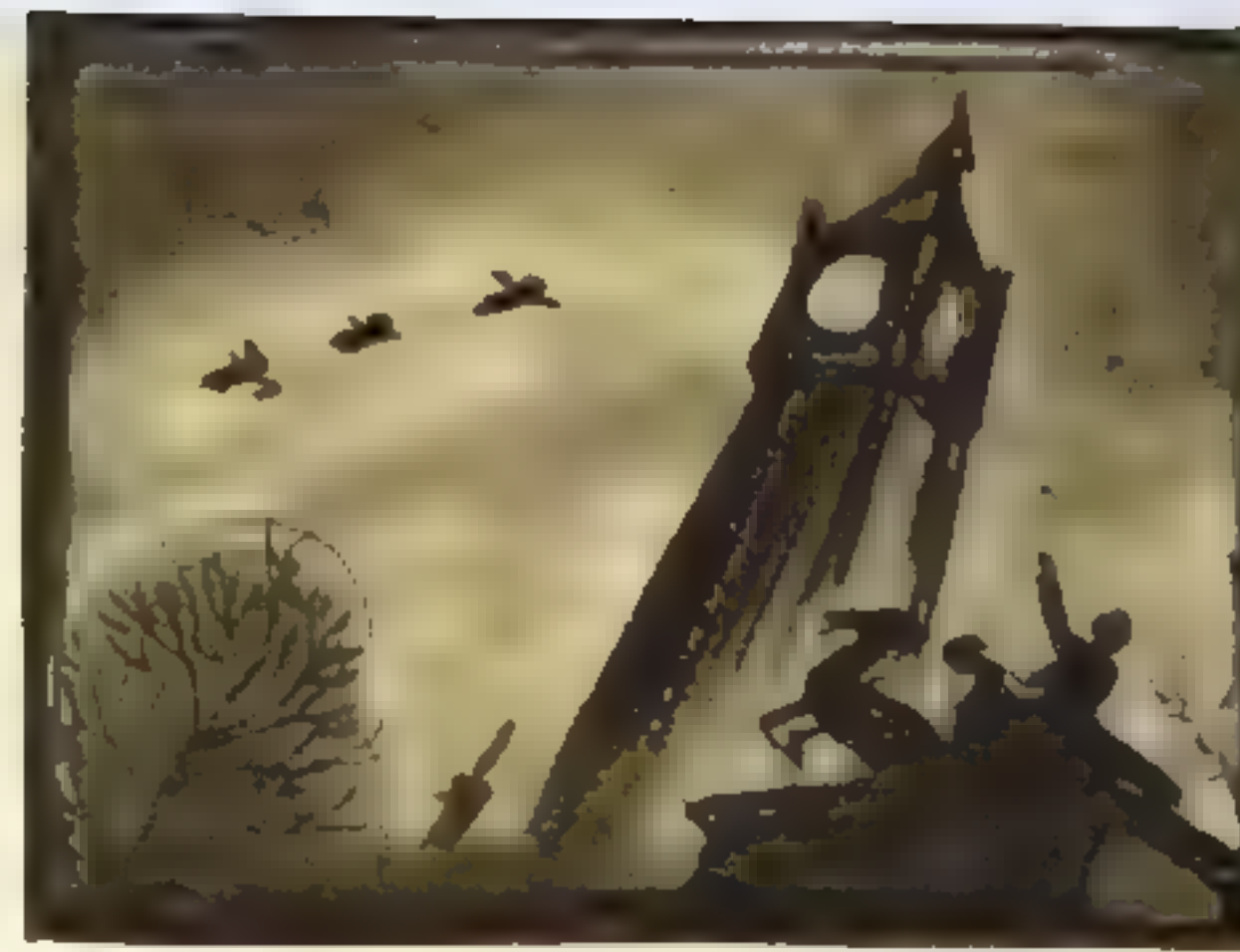
the timing for the story sketches documented on the story reel at that time. Then Dan would indicate where the cuts were: between this drawing and that drawing. The editor would then go back to the story reel and identify footages so the next morning we would have all the footages for a new cut.

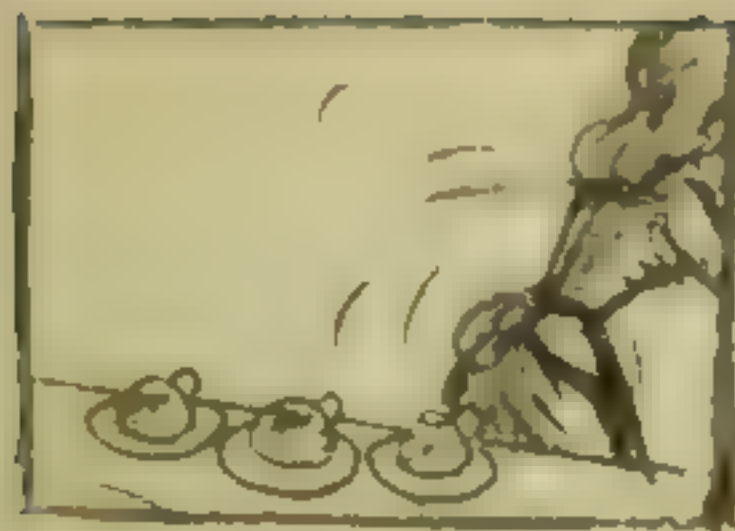
At that point we would take the storyboard and we would clean up any of the additional rough sketches that were just too rough to deal with and we’d indicate the footage along with notes that indicated any type of camera movement and whether that movement needed to start or stop at a certain point in the dialogue. All that information would be handwritten underneath the sketches on a scrappy kind of 11x17 [inch] page, with these drawings attached; that became the workbook that we used.

above. Faced for the first time with the challenge of preparing artwork to be scanned and manipulated digitally (and taking inspiration from their mentor, Ken O'Connor), Bill Perkins and his colleagues developed a new, "down and dirty" approach to the storyboarding and workbook phases of production on *The Rescuers Down Under* (1990).

Below. In the 1950s Ken O'Connor laid the foundations for the "Workbook" approach to feature animation layout at Disney by developing a more fluid "cinematographic" approach to the staging and photography of the individual scenes within each sequence, working from the individual storyboard sketches, he would create more detailed "cinematographic" drawings and framing diagrams which gave an idea of the continuity of both character action and camera movement.



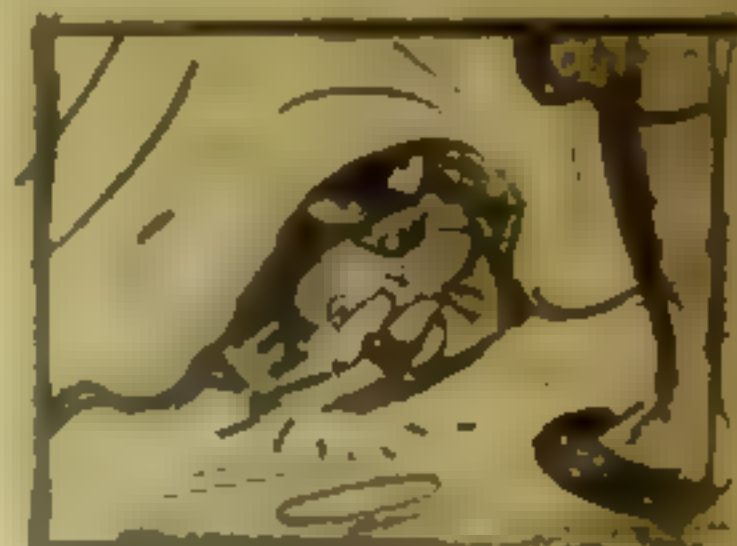




PUTS CUP BACK QUIETLY AND GLANCES OVER SHOULDER AT CINDY.

(THIS MAY PROVE BETTER TO BE AFTER THE MIDDLE CUP THIS TIME.)
O.S. JANGLE OF CALL BELLS AGAIN.

TRUCK BACK ↘

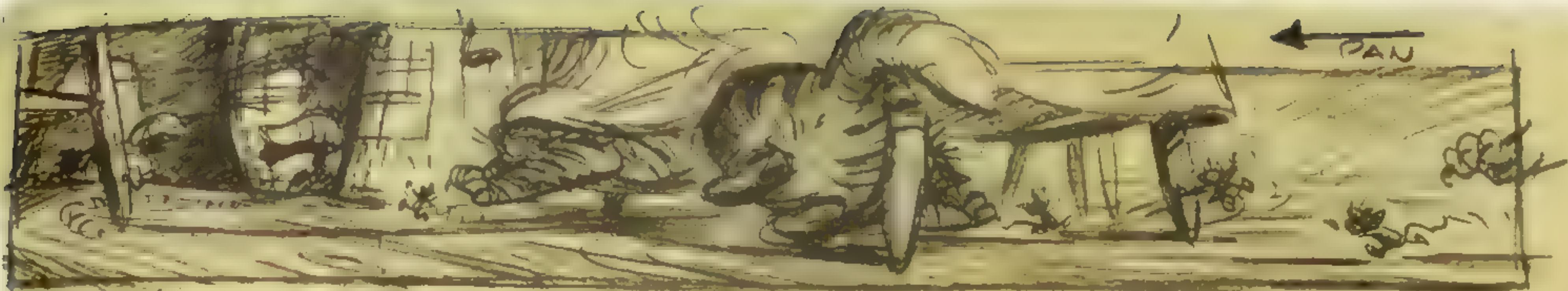


CINDY - O.S. "COMING"

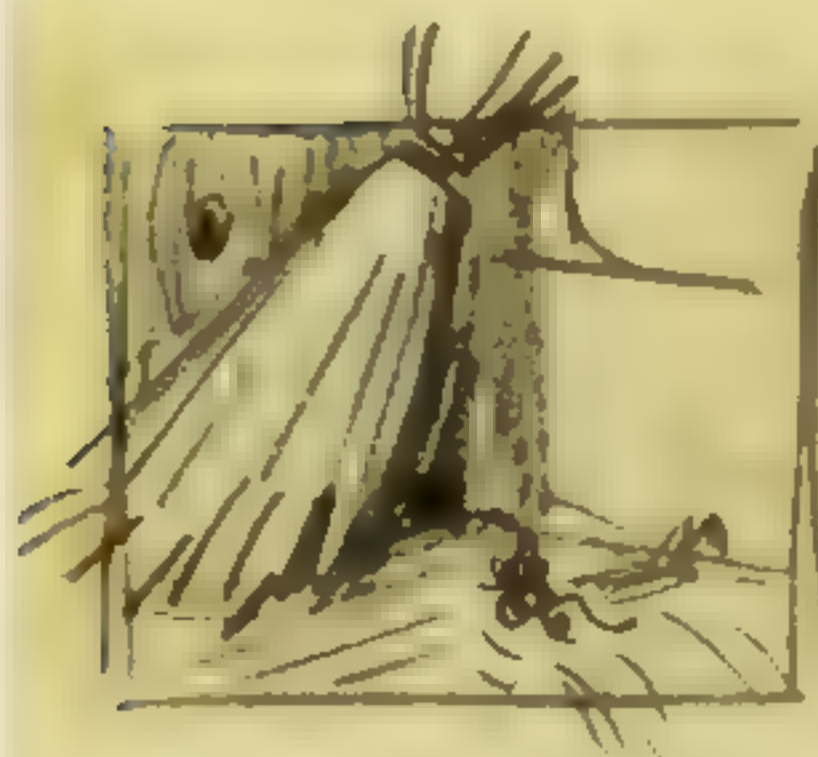
(ARRANGING THE CUPS)
POUR

POUR

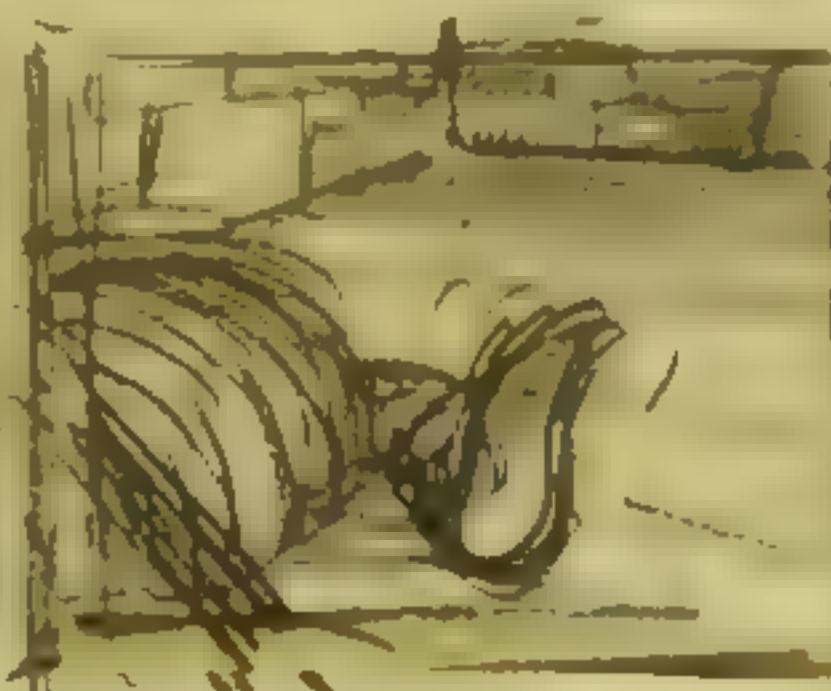
LAT IS IMPATIENT TO GET BACK AT HOUSE.
(CALL BELLS START AGAIN HARDER)



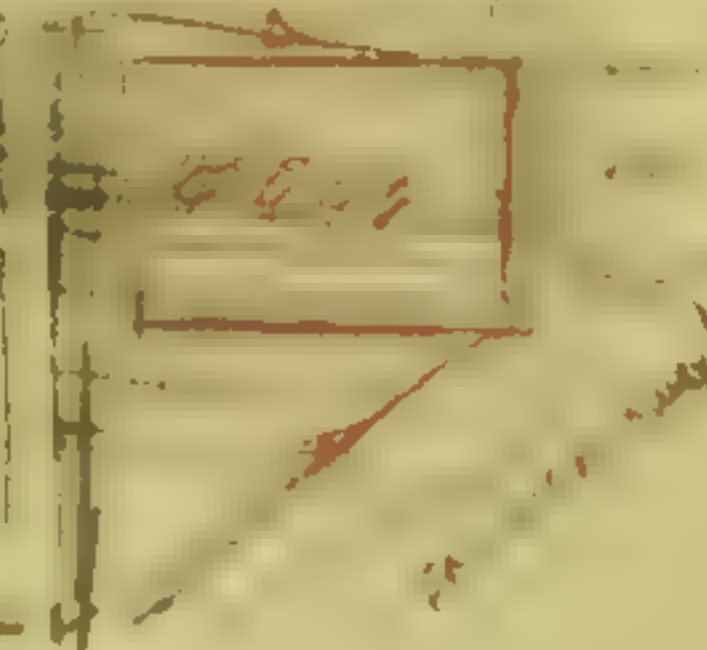
WILD PAN CHASE ZIG-ZAG BACK & FORTH UNDER TABLE - SEAT ETC - (TRUCK BACK NEAR END OF PAN TO AID LONG SHOT EFFECT)



JAQ SIGNALS ITS O.K FOR THEM TO START



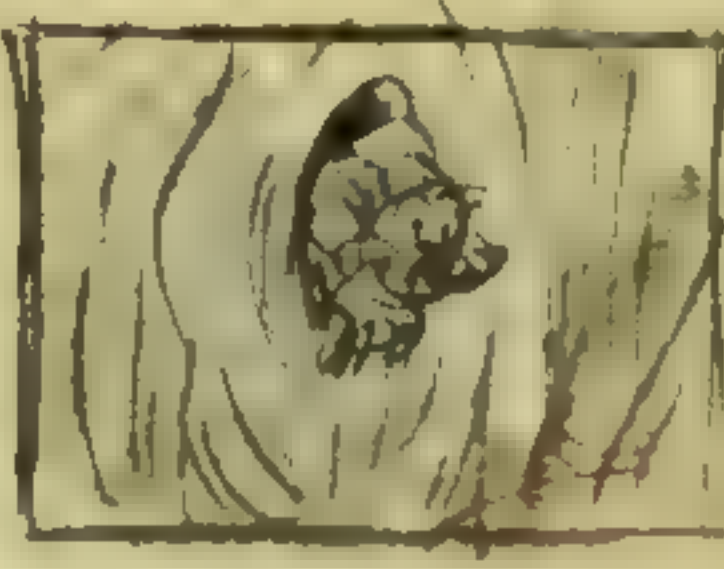
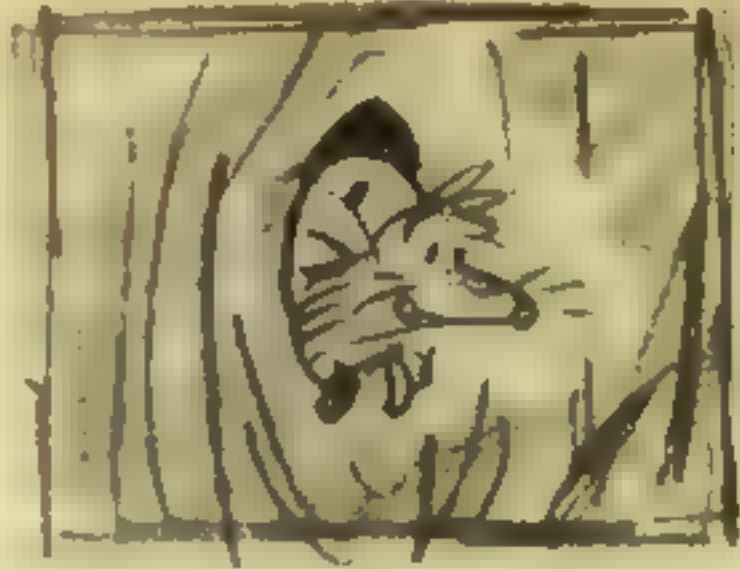
L.S. SHOWING GANG LEAVING HOLE FROM JAQ'S VIEWPOINT



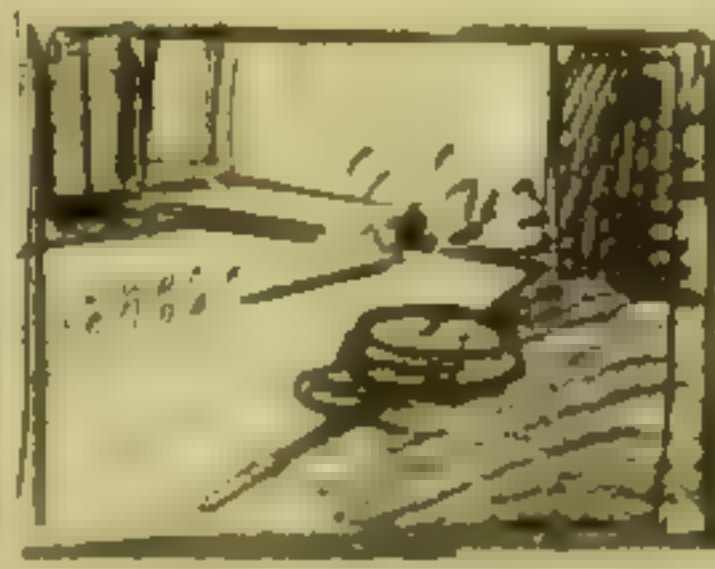
TRUCK DOWN ON GANG



GANG RETURNS JAQ'S SIGNAL AS THEY SNEAK OUT OF HOLE AND START ACROSS ROOM.



JAQ WATCHES THEM SNEAK -



(ALL GET OUT) GUS IS LAST



URNS TO WAVE FAREWELL - DORNT SEE THIDES HOLD



DOWN AND DIRTY

Because hand-drawn scenes will often be worked on one at a time, the animator needs to be aware of the timing and trajectory of any camera movement within the scene, information that isn't always clear from the diagrams that indicate camera placement and framing. The movement of the camera may influence both the timing and the final staging of the character's performance in ways that might not be apparent from the suggested "key" positions in the original rough storyboard panels. Clear "hook up"² information is required too if there is to be continuity with the scenes that precede and follow.

At this point in the process, the layout team also has to calculate exactly how many separate pieces of scenic artwork will be needed and which items, if any, can be designed for use in more than one scene. Depending on the scale and complexity of the environment depicted in any given sequence, smaller or larger teams of artists may be needed to manage and complete the work. As Bill made clear, however untidy their methods might have been, these lock-in workbook sessions quickly became an exercise in economy, forward thinking, and ingenuity:

With the transition from 35mm to digital, the number of possible layers of animation and BG artwork in a scene became infinite, so there was a big leap in the amount of work to be done. The learning curve was steep, about half of the people in the department were trainees right out of school, but we did the whole movie with seventeen people, because we used a workbook, even though it was implemented in a really down-and-dirty way.

Working that way, Dan could secure all the background footages too. We did the little sketches and indications and put them on a storyboard for each sequence and we'd have floating teams within the department so that, if it was a big sequence, we could absorb three or four artists, while a small sequence could be handled by one or two. One of those people would then become a point person for the clean-up of that sequence.

Then we would get this workbook, have a meeting with the artists, and basically launch it into the Layout Department. If we had a meeting on layout for a sequence on Monday, the sequence would be in the department by Wednesday. It was in and moving, that quick.

SCENE PLANNING

Where once there would have been an ongoing conversation between the layout artists and the camera operators about the practicalities of photographing each scene on a traditionally animated feature film or TV series, the disappearance of the physical apparatus of the camera itself meant that the precise nature of the operators' work changed.

The artwork, of course, still needed to be captured so that a version of each drawing, painting, and diagram was available to be manipulated, combined with other elements, and choreographed within the now computerized production system. The work-in-progress on any scene or sequence could now be viewed on a monitor at the touch of a button and discussed or adjusted, even at a rough or incomplete stage. Since nothing need be committed to film negative until everyone was satisfied with the composite image they were viewing, elements could be altered or replaced and changes could be made without incurring the kind of prohibitive camera and laboratory costs that comparable changes would have caused in the predigital era.

The migration of staff that resulted from this shift in technology meant that some animation technicians chose to specialize in what now

OPPOSITE Left by his boss, legendary Disney animator Frank Thomas, to do his own scene planning, junior animator Gary Goldman worked hard to resize all of the characters and register them firmly to the ground plane of the background layout in this extended panning scene.

Robin Hood (1973)

Directed by Wolfgang Peta

became known as scanning while others moved into an area known as scene planning. The department itself was by no means new, however, as Disney veteran Gary Goldman, now a producer and director for Don Bluth Films, explains:

I don't know the exact year, but scene planning has been around since the late '20s or early '30s. For sure before *The Old Mill*. Whenever there were trucks, pans, or rotations of the camera you needed to work everything out in detail before it went to camera and especially when they came up with the multiplane camera bed, things became very sophisticated and mathematical.

When I first started at Disney in 1972, Ruthie Thompson was the scene planning supervisor but on my first professional assignment, as in-between to Frank Thomas on *Robin Hood*, he gave me a scene with three rabbit siblings and a turtle running along a road to the edge of an open field. He had created the run cycles for each character on a separate level, and the drawings were about 4 to 5 inches high. Frank instructed me to draw the characters' actions small, about 1 to 1½ inches, and run them across one long piece of panning paper; as the older ones slowed down, the baby rabbit would catch up.

He also told me to do the scene plan myself, allowing the children to "lead the camera" and then have the camera catch up as the children slowed to a stop. But the scene was 8 feet long, all on ones, which meant there were 512 character drawings, four to each sheet of animation paper. Then he dropped the bomb: he and Ollie were going to Japan with their wives for two weeks and I was to have the scene ready when he returned. And he said for me not to seek assistance from the Scene Planning Department.

I'd had every math course available in high school so figuring the camera move wasn't that big of a challenge, but I was doing this for Frank Thomas, the legendary supervising animator at Walt Disney Productions—so it was a little daunting.

Those people who had joined the Scanning Department adapted their skills to the requirements of the new digital "down-shooters" whose lenses were still aimed directly at the artwork positioned beneath them but whose insides were now full of circuit boards rather than 35mm film reels, while the second group took up the responsibility of creating, in the computer, the specific required movements of the virtual cameras and digitized artwork elements in each scene.

As with so much of the work governing camera movement and timing, this part of traditional feature animation production required the scene planners and the layout artists to work closely together. Just as the work of a camera operator has always been about much more than photographing artwork, the layout artist has always had to think way beyond the pencil and the page. As Bill Perkins again points out:

It's not just drawing pictures, it's, "How do you make a movie?" Because the artwork that you do means working from the storyboard, you work with the directors, you do some roughs, those roughs go out to animation, they come back, they get checked, they go back out, they get cleaned up. And the artwork's coming back and forth so you get the setup for each scene.

And there's scene planning too. The Layout Department will get a rough-test version of the scene from Scene Planning and make sure everything's working, then the artwork comes back, gets cleaned up, and then it'll move on. So, in the

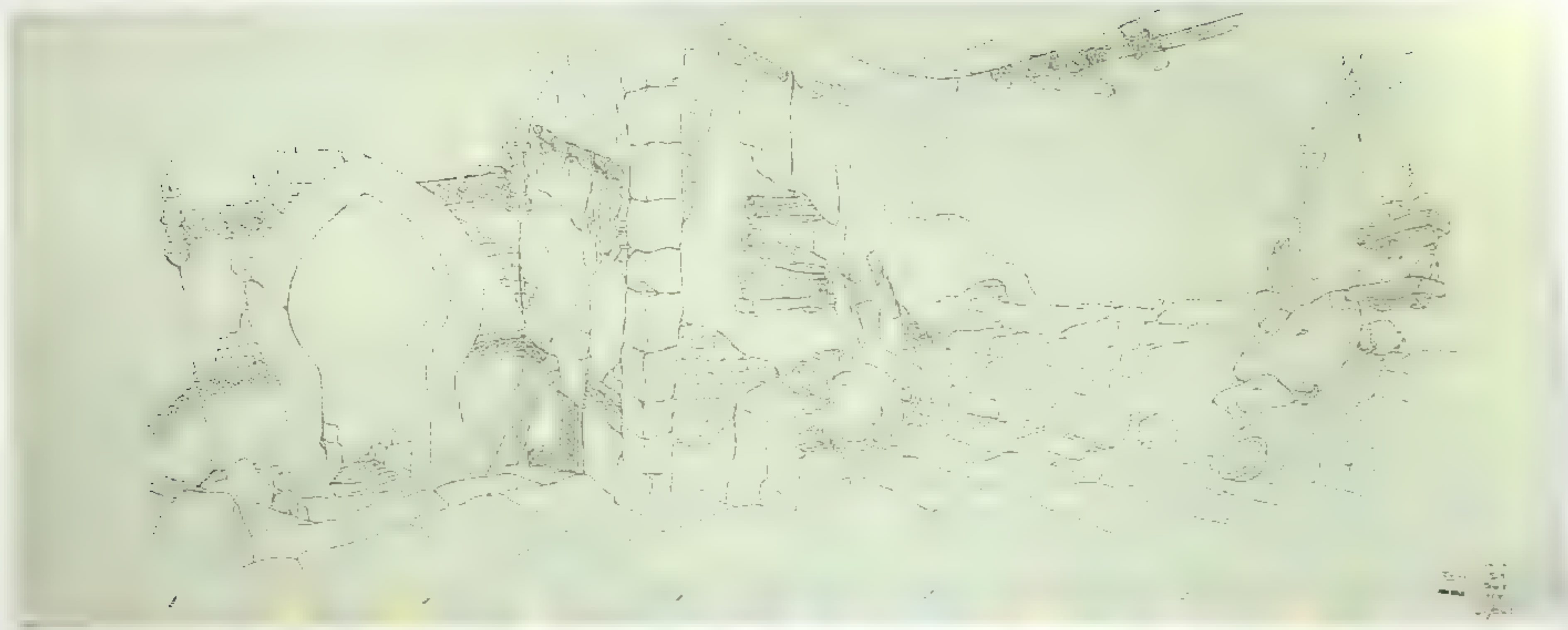
Layout Department, you're not done till you're done! And that's the thing that I think is the greatest thing about layout: you're more integrated into so many steps of animation production. You really get an eye on how to make a movie.

Originally all of this work was still governed by the handwritten exposure sheets that traveled along the production pipeline with the artwork, indicating how much of the required artwork for each scene had already been completed and just what each subsequent department was required to do with (or add to) each or any of the components.

All of the tangible elements, from the artwork itself to the paperwork that described it, still had to be archived and filed. Not surprisingly, as more of the work began happening in the digital realm, all the intangible, virtual material needed to be logged and charted in a similar way. This meant that, in addition to the software that helped the technicians and artists to move and affect the various scanned drawings and paintings, complex file management programs, some general, some project-specific, had to be created so that the traffic of digitized images, figures, and documents could be tracked and controlled.

Faced with increasingly prohibitive production costs, high-turnover TV animation studios like Hanna-Barbera had begun exploring the potential benefits and economies of computer systems at around the same time as the Disney engineers were developing CAPS to help oil the wheels of the still largely mechanical feature-animation pipeline. By the time Disney's in-house software was in place, a variety of different off-the-shelf animation production software packages were already in development.

Because animation cinematography involves such a high volume of detailed and overlapping arithmetic, scene planning and layout work both



As the Disney feature animation crew became more familiar with the CAPS production software, new methods were developed to calculate the intricate scene "mechanics" which dictate the relative speeds at which the various levels of scenic artwork move, in front of and behind the character animation.

TOP: Original cleaned-up BG layout drawing for the city and the Sultan's Palace

MIDDLE: Original cleaned-up BG layout drawing for the OL (overlay) of Aladdin's Hideaway

BOTTOM: Frame enlargements of final scene *Aladdin* (1992)

Directed by Ron Clements and John Musker



BEHIND THE SCREEN AT HANNA-BARBERA

by John Lewell

The following text is a scan of a document, likely a script or storyboard, with multiple lines of small, illegible text.



These VAX 11/780 computers configured as a VAXcluster (with 8 gigabytes of disk storage) form the heart of the Hanna-Barbera computer-assisted animation system.

See him outside Hanna-Barbera Fred's... (text is partially obscured and difficult to read)

catch glimpses of them strolling across the parking lot. In fact, the scene... (text is partially obscured and difficult to read)

THE PATH TO FAME

Bill Hanna and Joe Barbera were the creators of the original Tom and Jerry cartoons in the 1940s. These were made for MGM and were among the great classics of traditional animation. Bill and Joe, and elaborately animated. Subsequently selling up on their own. Hanna and Barbera

March/April 1988

Computer Pictures 15

require much the same kind of right brain/left brain versatility as computer programming. By the late 1980s, most camera operators had already been required to master the computerized motion-control systems which, when attached to a rostrum camera stand, allowed precise movements to be designed, executed, and, most important, repeated by gearing systems that were moved incrementally, not by hand but by tiny servo motors.

With this kind of knowledge and expertise already under their belts, it was perhaps more of a relief than a burden for some of these craftspeople to take the next logical step into a working environment where not only the movements of the camera but the artwork itself was represented by numbers. That being said, there was a transitional phase during which pretty much everybody seemed to be juggling calculators of one kind or another, as Bill Perkins remembers:

We did it all on a pocket calculator! In the Layout Department on *Rescuers Down Under*, because it was the first movie we had made with CAPS, we had no mathematical relationship with depth. It was all a flat composite so it was all shooting from the hip. And even though we had many, many layers, we didn't have any kind of formula for making those layers work properly together in terms of our spatial depth.

So we were doing drawings, and Scene Planning would then take those and try to puzzle them out. We were going back and forth and trying to figure it out, but it wasn't until the end of that show and the beginning of *Beauty and the Beast* that some of the guys in the Layout Department finally began to solve the problem. And I think Daniel Hu really should be credited for a lot of that because he was working it all out on his pocket calculator, finding ways to ratio the relative movements of the different scenic levels.

The digitization of so many methods and procedures meant that most of a scene planner's work could take place in front of a computer monitor rather than in the confines of a darkened camera (or scanning) room. Better still, the typing in of a wrong number could easily be reversed or corrected, whereas the photographing of a single drawing out of sequence would, in the pre digital world, have meant all the photography on a scene having to be started again from scratch.

But alongside the numerous advantages these early systems brought, there were some new and rather tricky practical problems to address, not least of which was the question of how to create and control variable focus, something that had happened "for free" in the physical realm of the rostrum stand. Because, like the character artwork levels, all the special effects and background

Computing power and storage capacity which, by the turn of the century, could fit beneath one desk or onto one personal laptop, filled several rooms at the Hanna-Barbera animation studios in the mid-1980s.

'Behind the Screen at Hanna-Barbera,' *Computer Pictures* (1988)

components in a scene were "neutralized" in the same way within the abstract, purely mathematical dimensions of the virtual computer space, layout artists had to find ways of reintroducing all the optical side effects created by the true spatial distance between a physical object and a physical lens. Bill describes the process:

Even later, when I was out of the Layout Department and I was art directing on *Aladdin*, I was in the Scene Planning Department constantly because we were looking at exposure sheets. When we would see a camera move, we would take the data for the move and Scene Planning might designate a certain type of path of movement, like a Bézier curve, and we would basically duplicate the mathematics of that move for any types of blurs, lighting changes, or anything. We'd duplicate that in the final composite so that you could set up a single frame and establish a blur, let's say, heaviest on the foreground layer and then incrementally less and less till you get to the layer where you want to have your focal depth. Then you might increase it slightly back again, depending on what the action was. We would take those blurs' values and apply that curve math to them so, as you went through, that focal depth would remain constant. Effectively we were using the layout data to maintain the focal depth, and that worked out really well.

Endnotes

1. See glossary.
2. See glossary.

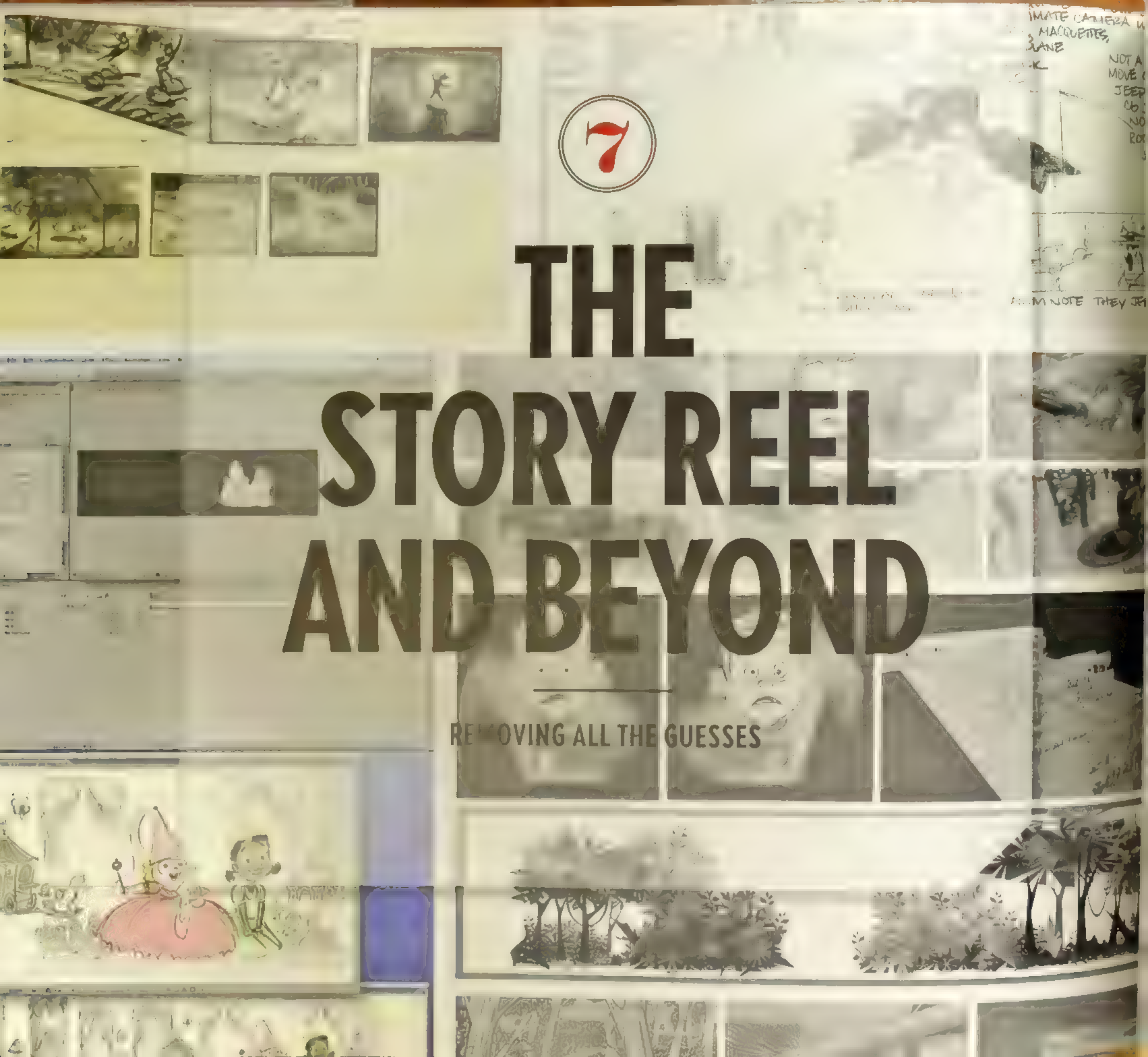


THE STORY REEL AND BEYOND

REMOVING ALL THE GUESSES

IMATE CAMERA W
MACQUETTES,
LANE
NOT A
MOVE C
JEEP
CO.
NO
RO

FROM NOTE THEY JA



As we've seen, from the 1930s all the way through to the 1990s, traditional animation artwork, from the story sketches and rough animation drawings through to the finished color artwork, was photographed using a traditional camera. Because rostrum camera work was both costly and time-consuming and because the original story drawings themselves were often much smaller than the eventual cleaned-up line drawings and cels, there was no easy way, when compiling story reels, to give a realistic impression of the intended camera movement in a scene.

For over half a century the shorthand way of getting around this problem had been for the story artists to draw arrows and framing diagrams, often in red, on top of their graphite drawings, giving a crude indication at best of the kind of cinematic flow the filmmakers aimed to achieve in the final edit.

With the development of computer software programs like After Effects™, it became possible for editors to apply smooth and ambitious camera movements, even to the tiniest of rough sketches. Visual effects such as blurs and dissolves, originally only affordable in postproduction, could now be introduced at this early stage, adding to the clarity and sophistication of the reels. The *animatic* was born.

Jeff Draheim was one of the first editors to recognize the full potential of the first wave of image-manipulation programs:

When I started at Disney in the early 1990s I was one of the first people to embrace software. Back then Adobe After Effects was called CoSA After Effects, and I talked my boss into trying it by saying, "Oh, you've got to buy this! It'll be great!" So we brought it on board in Special Projects and now it's become a standard part of the toolkit for all Editorial Departments.

Whenever possible I will always ask for oversized artwork and multiple layers so I can actually

take the images, put them in After Effects, then figure out the camera moves, work out the timing, and so on. And, in the end, that process actually helps with layout because they can see, "OK, we do need 6½ feet to get from Point A to Point B if this is roughly our background." I just love being that hands-on, being able to construct the whole sequence and help create the flow of it that way.

As the newly available software allowed ever greater sophistication in the creation of story reels, a new term was coined: animatic. For Andy Jimenez, his very first job in the industry put him right at the middle of this new development in animation preproduction:

My first job was on *Iron Giant* and Brad Bird wanted to do these animatics for the story reels. When the movie's in story reel form, it's the most vulnerable it's ever going to be because it's the most open to interpretation. More decisions are going to get made about your film and what you get to do, how much money there is, or whatever when the movie's at that stage than ever again in the process, but yet it's the most rough-looking it'll ever be as well.

So Brad wanted to make a story reel that was very complete looking, where all those guesses about what was going on were removed. Previously we

cut the storyboards together and did "scratch" voices and music and all that. But Brad wanted to remove the thing that can sometimes make it confusing for people who aren't used to looking at story reels, which are the arrows: "Is that a camera movement? Or is the character walking? The drawings that are 'popping,' do they represent cuts or a camera move?"

On *Iron Giant*, I was taking the drawings that the story artists were doing and scanning them into Photoshop™, and then, if the camera's panning from A to B, normally there's just the drawing with an arrow and then we just cut to that drawing. But I'd have to draw a layout of the space in between, make a digital version of that, and then, in After Effects, do an actual camera move.

Used intelligently, techniques like this can help the Editorial and Layout teams to eliminate any of the ambiguities that outsiders, in the past, have tended to find so perplexing about the on-screen collage of "held" rough sketches that, in the pre-digital age, might still have featured many of the notes and diagrams made by the story crew. Compared to a truly polished animatic, old-fashioned story reels can seem primitive while, as Mark Andrews recalls, compared to a story reel, an animatic can help "sell" a sequence, even to those who may not be looking at it as a blueprint or shopping list of the work still to be accomplished by their own departments:

Andrew Jimenez and I worked on *Spiderman* together and then, once we got back up here to Pixar, we continued to integrate the drawings into digital animatics. We came up with a process that was quick for us: I'd give Andy all the pieces and we'd go from the static boards into whatever camera and After Effects work needed to be done,

PREVIOUSSPREAD Collage of artwork from this chapter.

RIGHT. Story reels were originally created by photographing and editing together "held" shots of the individual story sketches. Film editors can now create a more polished kind of reel, known as an animatic, by scanning story sketches and larger items of purpose-made rough artwork and manipulating them digitally.

Story sketch artwork created for a panning shot in the animatic for Sequence 1.5 *The Princess and the Frog* (2009)

Directed by John Musker and Ron Clements

Edited by Jeff Draheim

Storyboards. LEFT and PREVIOUSSPREAD by Josie Trinidad, RIGHT by Tom Ellery

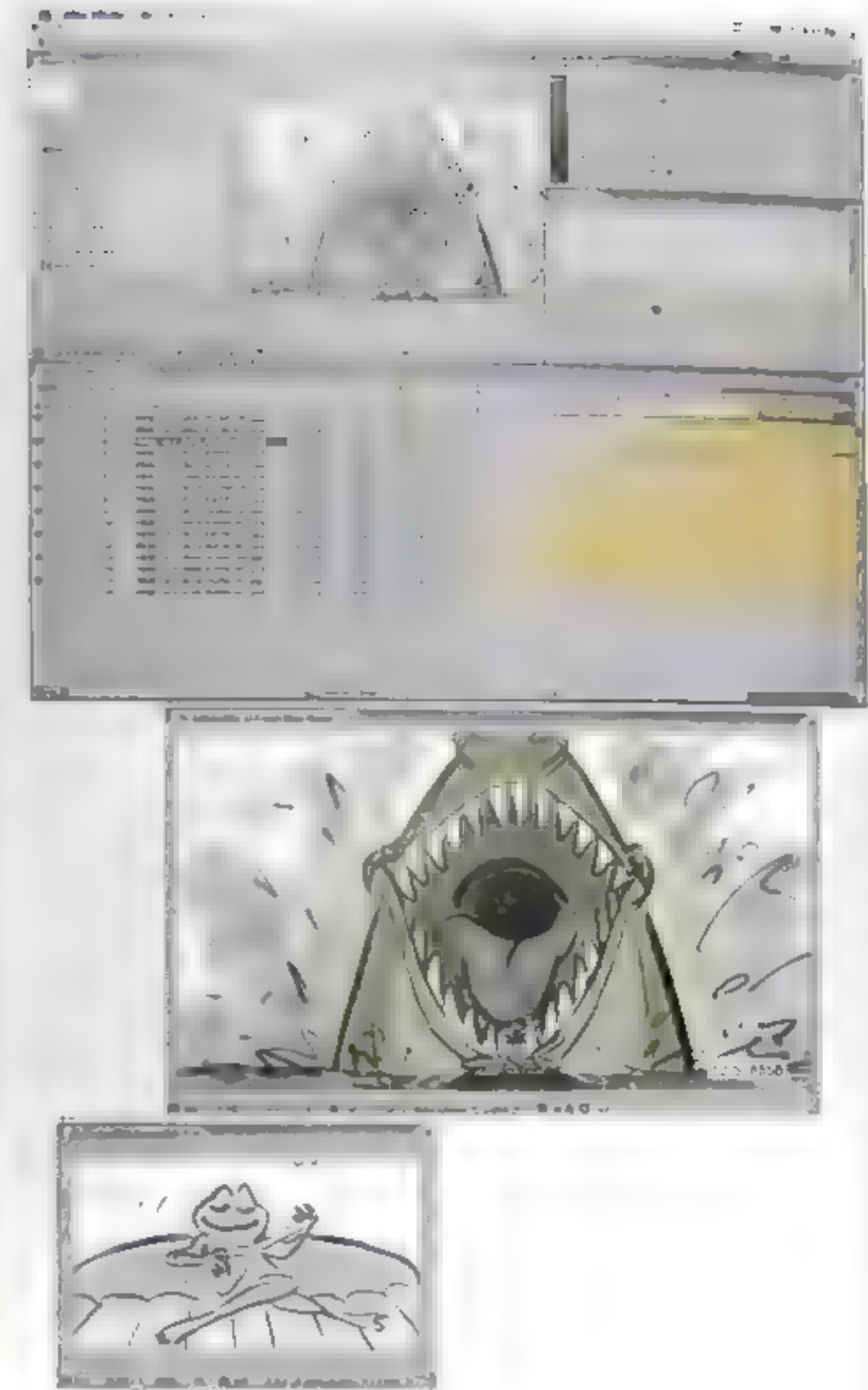
so the process was as seamless as possible. The first time we showed the first two acts of reels on *The Incredibles*, everybody came out of there going, "We could release this!" because it was that detailed.

THE RETURN OF THE GHOSTLY GRID: VIRTUAL MATERIALS, VIRTUAL EQUIPMENT, AND VIRTUAL LIGHT

The physical camera has, over the years, enjoyed a troublesome relationship with the hand-rendered image. Photography, in the early years of its existence, was often accused of trying to replace both painting and illustration, while even the most recent attempts to secure a respectable place for optical devices such as the camera obscura and the camera lucida in the recognized toolkits of fine artists such as Vermeer, Ingres, and Caravaggio have prompted outcries from contemporary painters who shrink from the very idea that "real" artists would sully themselves by looking through a traditional lens, let alone seeking to fix any image projected by one.

And yet, in the world of animation, we find a group of artists who, for the better part of a century, succeeded in proving that a productive (and at times truly astonishing) relationship can be established between artists and cameras. As we've seen, even if they rarely visited the rostrum camera room in their own studio, most animation artists had to be familiar with the apparatus itself and with the basics of the photographic process.

When we think back to Muybridge's studies of movement, how odd that the first thing most of us should see when we look through the digital "camera" inside a 3D computer environment should be a mathematical grid. It's perhaps fitting though when we consider that, while the apparatus through which we peer into the virtual world is represented in the user interface by a tiny



wireframe diagram of a real camera, complete with a little film magazine and a tiny lens, both the device itself and the "light" it was designed to capture are essentially mathematical constructs.

VIEWING TRANSFORMED

For all that we can't actually touch or hold them, the virtual cameras that are now commonly used to capture both computer-modeled and traditional, hand-drawn animation artwork do have a history. But while the animators at Ub Iwerks's studio in the 1930s could all watch from their desks as their boss unloaded the various component parts from which he intended to build his own revolutionary camera rig, many of the digital tools and devices that animators now use were designed, developed, and assembled not by technicians working in the same building but by professionals working in an entirely different industry.

The teams of academics and software engineers who were pushing the boundaries of computer graphics in the early 1970s worked mostly from the campus of a university or for one of the institutes of technology. To begin with, the annual SIGGRAPH gatherings¹ at which these different teams presented papers and compared notes had little input from (or dialogue with) the entertainment industry.

Even when off-the-shelf modeling, compositing, and animation software packages began to appear in the mid-1990s, none of the toolkits they offered had been developed in view of the artists who would be required to incorporate them into their existing work pattern. For most people in the animation industry, the virtual camera simply appeared on their desks fully formed. As a result, many animators, layout artists, and even directors remain unaware of the context in which digital animation photography developed.

TOP: In the predigital era, once the individual drawings had been captured on film in "Story Reel" form, graphic elements such as the directional arrows could become ambiguous and confusing.

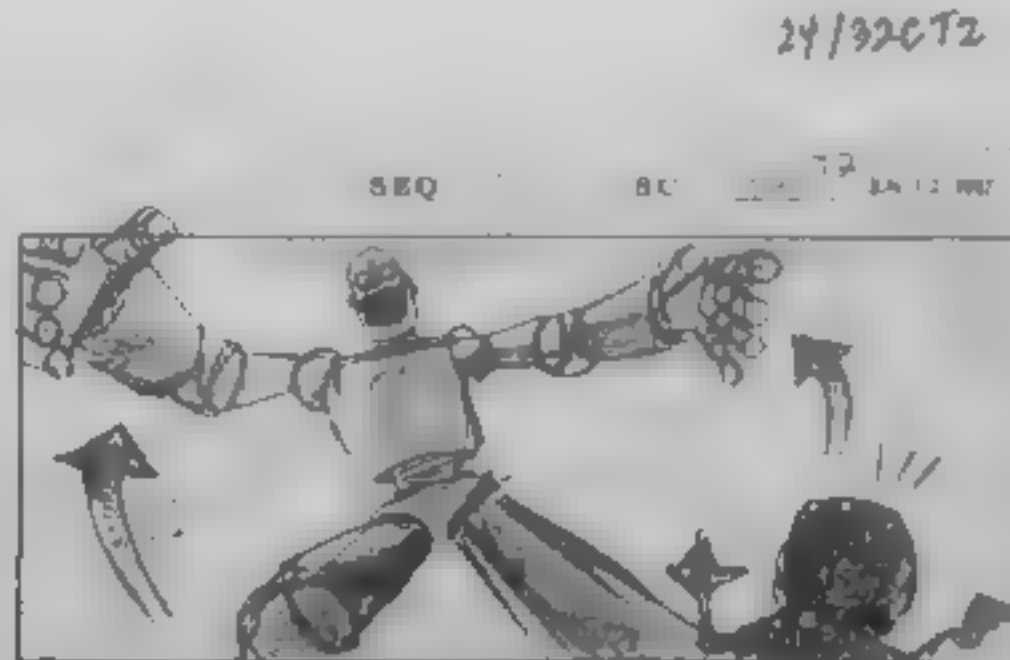
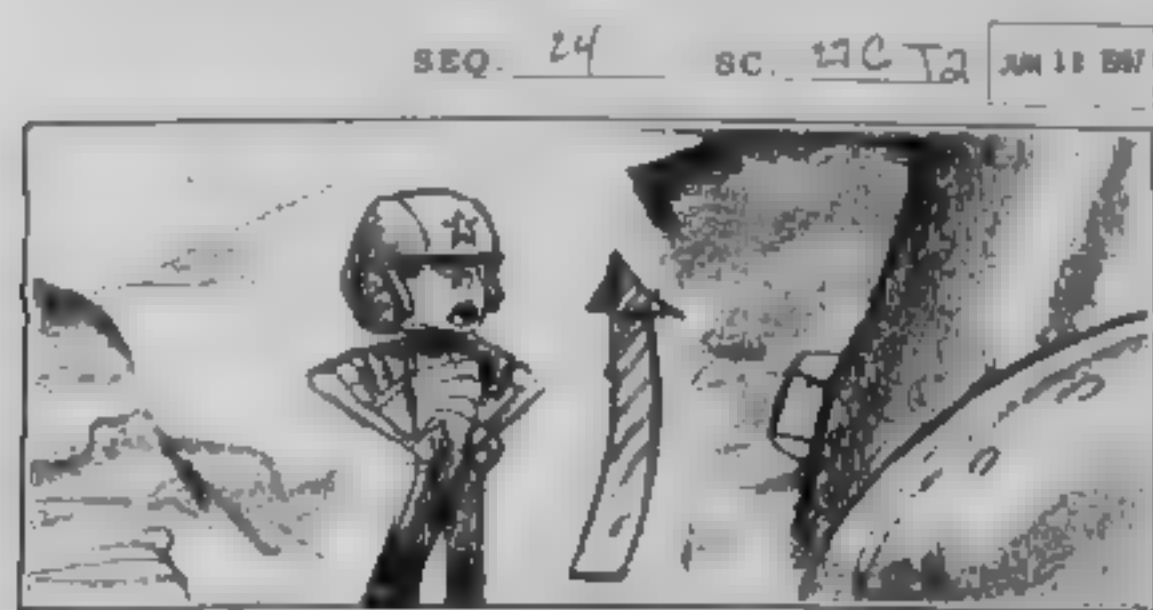
LEFT TO RIGHT: The storyboard panels of scene 24 from *Star Wars* (1977).

DESCRIPTION: The Rebel Pilot in *Star Wars* (1977).

ANIMATION: A storyboard panel from *Star Wars* (1977).

BOTTOM: On animated features, the development of the storyboards into an animatic is often accompanied by the creation of a "workbook" in which framing instructions, camera movements, and editorial continuity are clearly indicated.

DESCRIPTION: A storyboard panel from *Star Wars* (1977).



H: NO GETTING UP. I BLASTED

Sequence 35, Scene 14

Workbook/DRAFT Information

257020 - 33.0 - 014.00

Description: Fig. 4 - 7

Dialogue:

Time Of Day: Afternoon

Location: EXT. JEDI TEMPLE

Mechanics Notes: THREAT TO THE REBELS' ESCAPE TO 3D

Hook Ups: REBELS' ESCAPE TO 3D

Same As: RUC 257020-33.0-017 & 018

Costume Notes: KARR: (SPEAKING) (SPEAKING) (SPEAKING)

Registration Notes: DELIVER TO GARY

Characters: Giant, Karr, General

Suggested Level Breakdown:

BC
1/1
ANIM: Giant
ANIM: General
EFX: (SPEAKING) (SPEAKING)
ANIM: (SPEAKING)
EFX: (SPEAKING)
ANIM: (SPEAKING)
ANIM: (SPEAKING)
EFX: (SPEAKING)

TD NOTE: USE MACQUETTE OF ADULTS IN JEEP TO HELP ESTIMATE CAMERA MOVE. PUT L.S. JEEP, MACQUETTES, AND GROUNDPLANE IN SCENE TO WORK OUT MECHANICS

NOT A 3D MOVE ON JEEP (TWO CG JEeps - NO ROTATING JEEP)

GENERAL - STANDING UP STILL SHOOTING

ANIM NOTE: THEY JEEP BACK

BELOW Image manipulation software puts digital cameras and effects toolkits in the hands of the film editor, allowing for smoother continuity and greater sophistication in the animatic.

Story panel/Animatic sketch (digital)

ROW ONE Dash Ted Mathot, 3D Velocipod by Mark Andrews,

Backgrounds by Andrew Jimenez

ROW TWO Dash Mark Andrews, Backgrounds by Mark Andrews and Andrew Jimenez

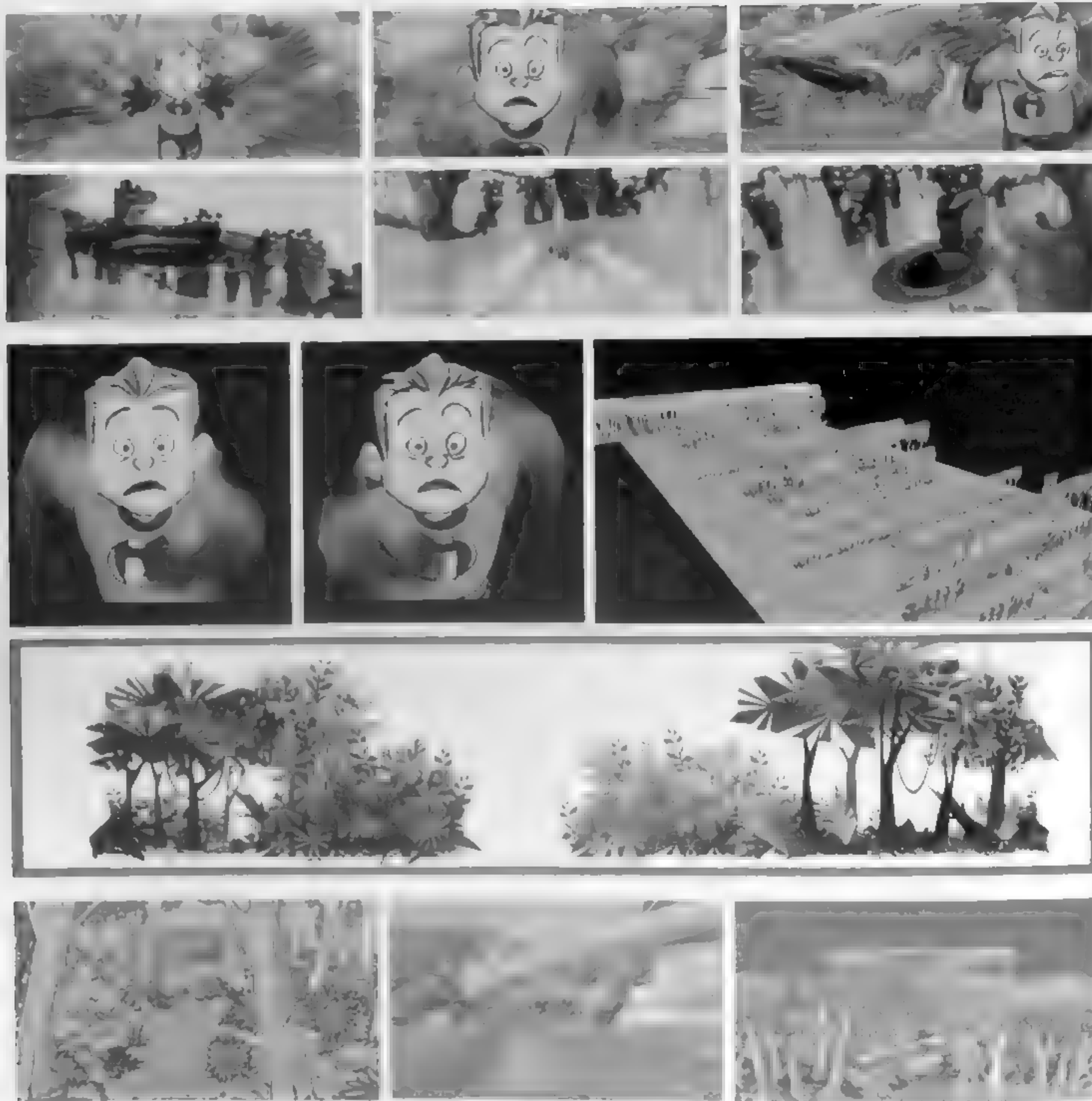
ROW THREE MIB Dash Ted Mathot © Jungle tree "flats" by Andrew Jimenez

ROW FOUR Jungle trees by Andrew Jimenez

ROW FIVE Backgrounds by Andrew Jimenez

The Incredibles (2004)

Directed by Brad Bird



OPPOSITE, LEFT, TOP: Just as Eadweard Muybridge photographed human and animal figures against a grid of squares, the better to study and calibrate their movements, so the user interface in many 3D computer modeling and animation programs provides a "floor" grid, to help the user "fix" the digital characters and objects in correct spatial relationship to one another—and to the virtual camera. Image created in Autodesk Maya™ by Joe Whyte

LEFT, MIDDLE: Because many of the virtual environments created for today's movie industry are modeled using software that has its origins in the early flight simulators created for use by the military, dramatic "aerial" cinematography can be accomplished within them at a fraction of the budget required for either live-action aerial work or traditional multiplane animation photography.

Aerial view of Swallow Falls

Cloudy With a Chance of Meatballs (2009)

Sony Pictures Animation

Head of layout: David Morehead

LEFT, BOTTOM: The path of devastation wrought by the twister is plotted out by using this bird's-eye render of Swallow Falls.

Cloudy With a Chance of Meatballs (2009)

Sony Pictures Animation

Head of layout: David Morehead

Visual effects supervisor: Rob Bredow

Digital effects supervisor: Daniel Kramer

RIGHT: Layout artists and animators working within the x, y and z axes of digital space now have access to a weightless virtual "camera," capable of "flying" through an imaginary environment; this same technology has been used for many years in flight simulators to provide pilots with panoramic views of virtual landscapes.

Photo credit: L-3 Link Simulation & Training

Pixar's David DiFrancesco (the man responsible for the first successful digital laser film recorder) kindly explained to me how the multi-lens CG cameras which now "fly" through 3D space in computer modeling and animation programs descended from the generic "pilot's view" displays generated by early flight-simulation software:

The seminal 3D work in the field fell to those who taught and worked at E&S and the University of Utah's computer graphics lab, the first of its kind in the United States. E&S was run by David Evans and Ivan Sutherland, and they developed the LDS-1 and the Picture System II, both 3D calligraphic (line drawing) machines that were first used as nighttime flight-instruction simulators—and even some that were used for ship piloting with full rendered images for daylight harbor simulation—in the late '60s, early '70s.

In order to present a realistic "view" of digital wireframe geometry to the person sitting in front of the computer screen (or monitor), all computer graphics programs had to be capable of rendering the object (or objects) from a single chosen point in the imaginary space represented by the x, y, and z coordinates within the system. Before it became common to refer to this chosen point as a "camera," it was known as the "viewing transform."

Any computer graphics system that is capable of displaying the geometry of an imaginary landscape to a trainee pilot should, of course, be capable of displaying similar imaginary worlds to movie-makers, maybe even to animators. The more this idea took hold, the greater the ambition of the software development teams, many of them imagining the virtual space within the computer in the same way as theater designers might imagine a stage. Others saw promising similarities between virtual space and the space that Disney and others had built into their more complex camera rigs.



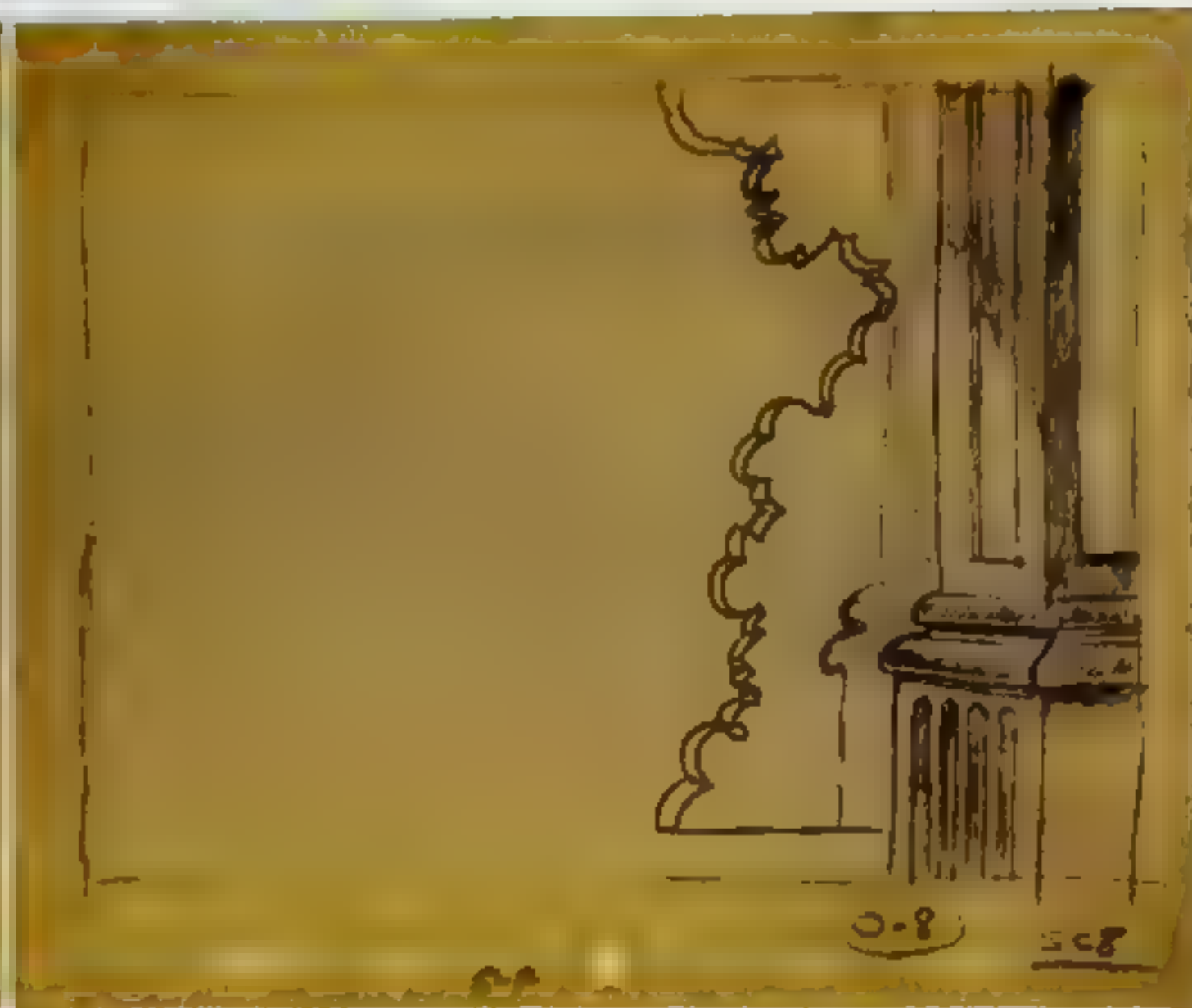
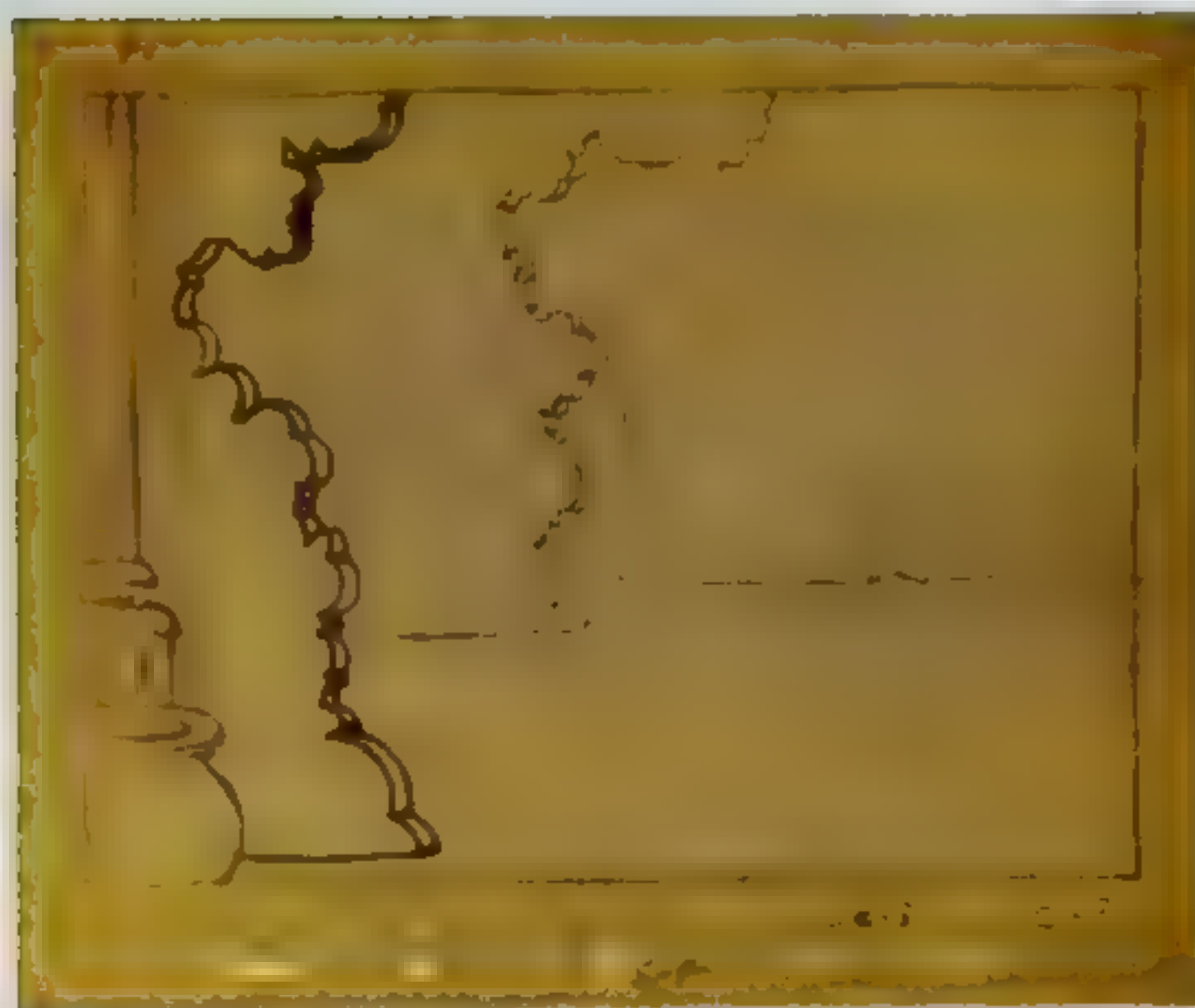
A founding Pixar employee and one of the true pioneers in the field of digitizing animation production, Alvy Ray Smith, noted how he and Ed Catmull eventually succeeded in digitizing multiplane animation photography. Here, once again, was the notion of theatrical set design, this time in the context of how 2-dimensional animation elements could be manipulated in the virtual realm, rather than in physical space:

I wrote a program at NYIT [the New York Institute of Technology] called Texas (TEXTure Applying System) whose metaphor was "stage flats" that could be moved about in a 3D space, flat images (not necessarily rectangular) being "textures,"² placed in 3D-space and projected into 2D-space for viewing. In the introduction to my July '79 tech memo about this system I wrote: "Texas is intended to be a generalization of the multiplane camera."

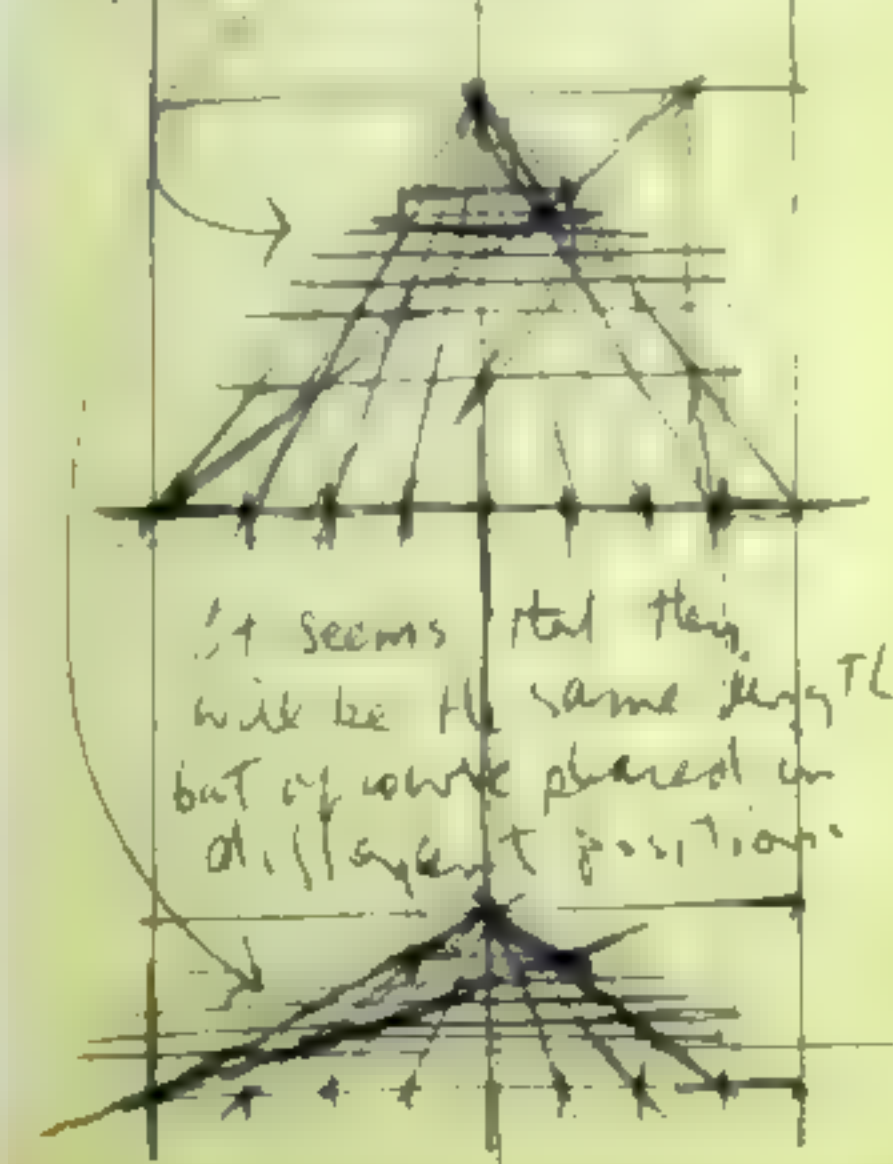
1257 "Stage flats" viewed from the performers' perspective.
Mickey's Amateurs (1937)
Directed by Pinto Colvig and Erdman Penner

1258 Subtle shifts in the angle and proportion of lines and objects will occur automatically when a live-action camera moves (in any direction) within a 3-dimensional set or location. In hand-drawn "flat" animation these same shifts have to be anticipated and, where it proves impossible to duplicate them, they have to be concealed. In this rough sketch Roy Naisbitt makes an important warning note about a possible shift in the relative dimensions of certain objects if the artist lowers the horizon line in the scene.

A Christmas Carol (1971), ABC TV Christmas special
Directed & produced by Richard Williams
Executive producer, Chuck Jones



check whether the lines are the same length regardless of the horizon line.



It seems that they will be the same length but of course placed in different positions.

The key idea in 2D animation, particularly layout, is pre-multiplied alpha and hence correct compositing. We had to come up with these innovations because we had set out to digitize the cel animation process. We did it without fully understanding it at NYIT, and in fact generated a 22-minute 2D animation there using the concept. The concept is the familiar one from cel animation: one moves several foreground objects (typically characters) in particular depth order above a background object (typically a painted background).

The alpha channel is the digital equivalent of the clear plastic sheets that Earl Hurd had so ingeniously patented back in 1915. In layman's terms, it meant that Alvy, Ed Catmull, and their colleagues had made it possible for any shape of digitized scenic element to be "cut out" and positioned in z-depth in front of the lens of the digital camera (which, try as I might, I still can't think of as a "viewing transform"):

The CAPS system had layout stations and all other aspects of prime-time cel animation production. But, in particular, it featured multiplaning, taking the notion to the digital limit. Directors were no longer restricted to a handful of multi-plane shots (with at most five planes, as I recall). Now they could make every shot a multiplane shot with as many planes as they wanted. The directors went nuts with this.

So geometric camera views could be used for layout of the shots, but execution of them required 2D composition of shaped images under precise control. CAPS was the culmination of what was possible by marrying 3D and 2D graphics to classic cel animation. Of course, layout in 3D graphics is just as important as in 2D. The camera view is fundamental, of course.

EARLY COMPUTER PRODUCTION FOR TV ANIMATION

Throughout the '70s and '80s various different university teams were working to develop viable

computer production toolkits for the animation industry and, in parallel to the work that Smith, Catmull, and their colleagues were doing at NYIT, Marc Levoy, Chris Odgers, and Bruce Wallace from Cornell University were busy designing the pioneering system that, as Charles Grosvenor well remembers, was eventually installed at the Hanna-Barbera TV animation studios:

Not long after I started at Hanna-Barbera in 1978, all the old offices and cubicles were turned into the new computer area and by 1981 we were producing shows on the computer. This was a pioneering move, but by today's standards things were still pretty crude.

There were at least three refrigerator-size computers in what used to be the assistant animators' bullpen. The room was converted over to a "clean room," and the temperature in it was always kept very low so you had to keep a coat or sweater with you for those days when you had to go in

According to James Williams, scene planning supervisor for *Spirit*, "In the layout process, the number of shots actually can change significantly. You can look at a storyboard or read the script and realize that what was originally intended to be multiple shots could actually be covered in a single shot or vice versa, maybe it could be communicated visually rather than by dialogue? Although the

spacing of the sequence seems to be determined by the storyboards, it's really not finalized until the layout determines how many shots actually make up that sequence."

Storyboards, artist unknown

Spirit: Stallion of the Cimarron (2002)

Directed by Kelly Asbury & Lorna Cook

and check a show in the computer room. There were three or four stations for people to do digital opaqueing, but while the color "flooding"³ was quite fast, it wasn't instantaneous.

For the Layout Department, computer shows initially posed a few challenges. The main one was that all scenes had to be laid out for 12 field, which may not seem that difficult, but when you had to draw close-ups of Smurfs at 12F it got tiresome. You also had to draw more backgrounds than you usually did because refielding for reuse was not initially an option.

You could always tell a computer show from a traditionally produced film episode. The resolution was at times rather crude, and you could often see the blocky pixilated outlines around the

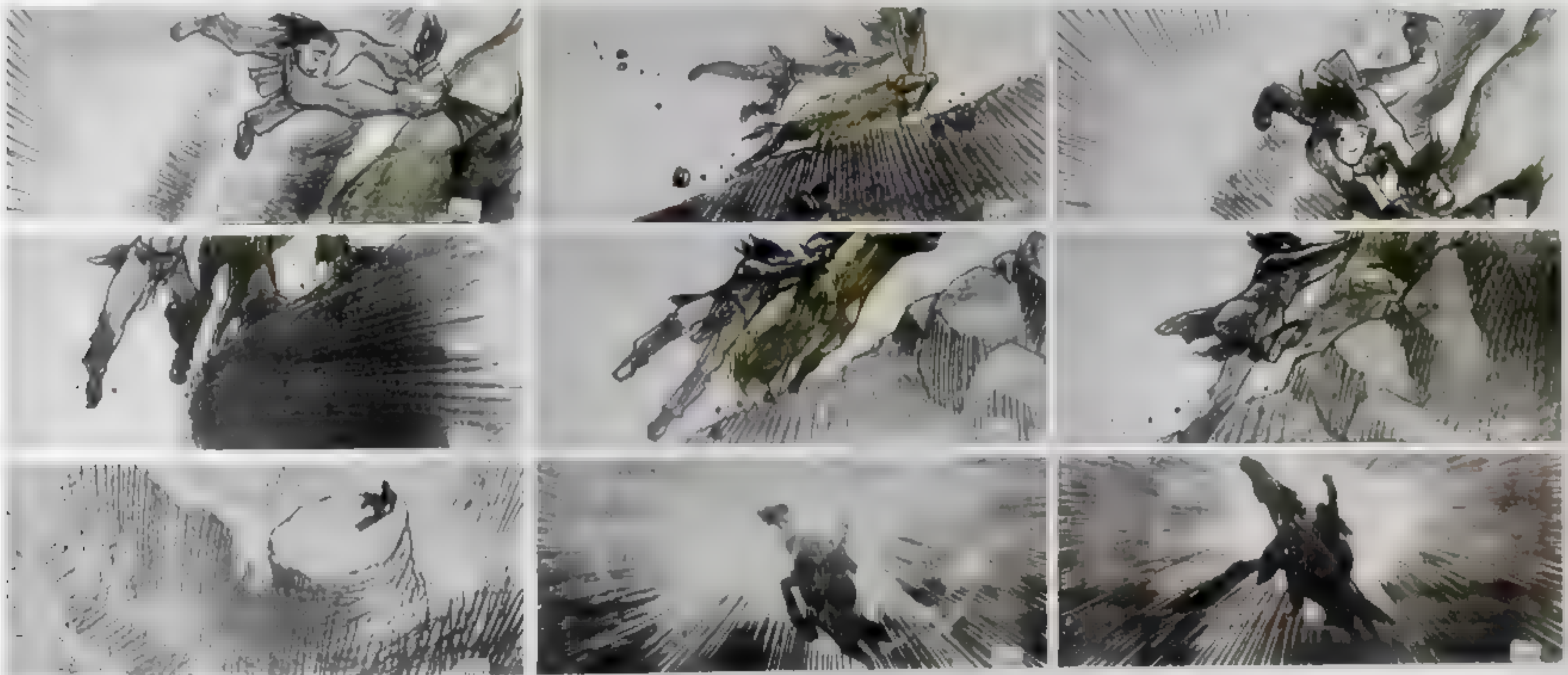
characters. Smooth arcs read more as curving staircases and the actual color read differently. Editing shows to length was also a problem. If you decided to trim the last foot of a scene, for example, instead of butting the new end of the scene up to the head of the next one, the computer would generate a foot of black instead. The computer length of the picture always remained the same until the final "print," which had the black spots removed. But until then you'd get this patchwork footage with lots of black chunks in it, which made it very difficult to judge the pacing of your episode.

The production of computer shows did get better and better, but eventually the development was not judged to be rewarding enough to pursue the concept as vigorously as it had been initially.

RIDING OFF UNDER THE SUNSET, OR THE BATTLE TO HARNESS PERSPECTIVE

In the days when "real" cameras were photographing flat animation artwork, the simplest and least expensive character movements an animator could create were those that, thinking back again to theater, kept the figures in the narrow space between the footlights and the fire curtain. In vaudeville, comedy acts often performed "front of curtain" to fill time while the stagehands changed the scenery and props around on the stage for the more involved dance and drama numbers. Many of the early *Silly Symphonies* took place in a theater, as much to confine the characters to this limited space as to capitalize on a performance format that audiences were familiar with.

Flat animation artwork could easily be moved east and west or north and south on the table



Hand-drawn animation usually requires teams of animators, assistants, and inbetweeners to work exclusively on one character for the duration of a production in order to preserve the “look” of each character. By contrast, once a character has been modeled, rigged, and “skinned” in the computer, it can be assigned to any animator and viewed from any angle without the risk of changes in

either the volume or the proportions of the geometry. Care needs to be taken, however, in the positioning of CG lighting sources, which can affect hair, clothes, and personal props such as eyeglasses.

Monsters vs. Aliens (2009)

Directed by Rob Letterman and Conrad Vernon



beneath the lens so linear camera moves were quick and simple to create if they kept to the horizontal or the vertical. Chase sequences could be cheaply created for TV animation because, as long as the action played in profile, the character movement could be created from “cycles” of drawings while, even if the action took place indoors, one long piece of PAN background could be endlessly repositioned and rephotographed on a sliding peg bar.

Charles Grosvenor recalled how easily the battle for economy in TV animation could backfire:

There was one particular studio that worked heavily on a “stock” basis. They wanted at least 30 percent of their TV shows to be stock animation; that way you cut costs, but they didn’t realize that if you have stock animation and you put a stock background with it, the artwork has to have the same perspective. I remember watching the end of one particular episode where these characters on horses ride off into the sunset but the layout artist had put the horizon line really high and the characters had been animated to a very low one, so it looked like they were about to go into a gopher hole or something! And I’m watching it and thinking, “No, no, no, guys! You’ve got to realize, you *can* put all this stuff together to save money—but it’s got to work!”

As the “tradigital” era at DreamWorks Animation reached something of an apex in 2D/3D hybrid design at the turn of the millennium, many animators encountered a level of complexity that was not always productive. The increasing depth and solidity of the CG environments combined with ever more ambitious camera work to make life difficult for the character animators who, at the time, were still working traditionally. As Damon O’Beirne recalls:

We were making stuff that was so complicated that we actually got into a little bit of an eddy with it. We put the animators through some really difficult stuff on *Sinbad* and *Spirit* and then suddenly we went digital and everyone said, “You’re going to find this so hard!” but I said, “No! After what we’ve been through, this is going to be much easier!” In some respects it was because now when we shoot there are always limitations, but not the type of limitation that we were thinking about then: “OK, if we’re going to put pegs on this, then how are we going to deliver this to an animator? And can he draw those angles?”

Going purely digital, you can move the camera more and you can make it more challenging for the animators, because drawing perspective was so hard for Layout, but also for the animators. Drawing these overlaps and distortions that happen in normal life was really difficult for them.

David Burgess, formerly a traditional lead animator at Disney and now animating in the computer at DreamWorks Animation, confirmed how liberating the digital toolkit can be for the animators in terms of the free perspective it provides:

The thing that’s hard about the hand-drawn stuff isn’t the performance—it’s keeping the character on-model⁴ and being able to draw them from left, right, top, and bottom and from all these crazy angles. I’m sure there’s a handful of 2D animators that feel it’s all about just the drawing, about the actual image. But I think if you talk to any 2D animator who lives and dies with the performance aspect of it, for them it’s always the rough pass that’s the most visceral and the most exciting, before you actually worry about putting it on-model and adding all the extra detail.

In the 3D realm, of course, you don't have to worry about that so it's all about placement of the character in space and what the character's doing and what that says to the audience.

It takes longer and costs more to give a convincing impression of the camera capturing hand-drawn characters from awkward angles, or moving away from the audience, because the artists have to render convincing foreshortening or draw increasingly tiny figures in correct perspective that matches the vanishing points of the environment. Multiplane photography solved some depth and parallax problems, but it remained too costly and labor intensive to attempt on a TV budget. Even on a feature movie, expecting the layout and background artists to render environments, props, and objects moving in perspective in front of a fixed lens was the least likely of all the options to be pursued.

Oddly enough, the very same problem that first prompted Earl Hurd to seek a patent on the clear plastic cel way back in 1914 has reappeared in CG layout in a way that rather undermines any notion of "free" digital perspective. This time it's the digital (rather than the manual) repetition of background images that's the problem. As Rob Cardone explained:

On CG films, moving cameras are expensive. The computer has to render these images so, if you have a locked-off static camera, you can render that background "plate"⁵ one time and then just have your animation play over it, which makes it relatively cheap. But when you have a moving camera you have to render the background plate every single time the frame changes. If you have a 300-frame shot you need 300 background plates. So there's a strong budgetary motivation to try to minimize the number of times you have to do that.

THE TRON BOX

Because computers, by their very nature, are predisposed to handle math problems, you could be forgiven for assuming that perspective might have been one of the first of the layout artists' problems to be alleviated by computers. As at Hanna-Barbera, the Disney artists had begun to experiment with computer-generated imagery even before the full implementation of CAPS. As Chris Wedge recalled, back in 1982 a lot of the geometry looked simple enough:

TRON was my first job out of college and I understood 3D pretty well conceptually and spatially. I hadn't been a 2D animator, so the translation to 3D was never a conceptual problem for me—it's always been a technical one. Back then the technology was so arcane that it was a bit like animating with ski boots on your hands. But it's funny, on *TRON* there wasn't so much of a translation problem going from 'boards to 3D because the environments were so simple—those were shots of grids!

However rudimentary these grids might have been, and no matter how correct the perspective offered by the computer might have seemed, there were some fundamental problems that the layout artists in particular needed to address. As Bill Perkins explained:

During *TRON*, when they "slated" the scenes with the clapper board⁶ they had the actor on a blank stage with the grid, and they had a stand with a box on it at the same height as the actor. They slated it with the box in there, and then they took the box out and acted the scene. That's how Harrison Ellenshaw knew how to do the matte painting. He would take a plate from the slate that had the box in it and then he would draw the perspective from that box. So it was a cube that delivered the

eye level and the actual convergence of the camera lens that was used for that shot.

Ellenshaw recalls how this worked in practice:

The cubes were my idea. With a background in matte painting I had learned how to back-project from a live-action plate to figure out the lens used on the camera as well as the amount of tilt. This was important as it dictated the perspective of the matte painting so that it would "fit" the live-action seamlessly. Back projecting is a lot of guessing and, hopefully, logical assumptions about positioning and distances of objects filmed in the live-action plate in order to find the horizon, the vanishing point(s), and importantly the 45-degree vanishing points. This is especially difficult if you do not have any architectural features in the plate.

Also, recording the lens and tilt was not usually done when shooting plates for visual effects. Today that's changed, and on studio films there is usually some poor guy whose only job is to record lens, f-stop, focus, tilt, distance to the nearest tree, etc. during production. It's a great job to have if it's a nice location like Hawaii! But in most cases the information is lost and never fully utilized anyway.

As a visual effects supervisor on *TRON*, I realized that even though we would record lens info, the easiest way to layout the backgrounds in post was, during production, to put a level cube into the frame after the scene was shot. This was especially important because the actors played their scenes against black. So I had two Styrofoam cubes made up, one was 1 x 1 x 1 foot and one was 3 x 3 x 3 foot. All of the live-action/non-CGI scenes were shot with a "tied-off" camera and, after the director Steven Lisberger was happy

Crew photograph including the smaller of the two "TRON Cubes."

TRON (1982)

Walt Disney Productions, Lisberger/Kushner

Directed by Steven Lisberger

Produced by Donald Kushner

Visual effects supervisor, Harrison Ellenshaw



Working from an original design by Don Bluth, the late Tim Hildebrandt demonstrated beautifully, in this early rough drawing for *The Secret of NIMH* poster (1982), how a powerful dramatic impact can be created with a single image, using very much the same command of strong tonal values and dynamic composition that a layout artist employs in the design of each fully animated scene.

Original poster rough by Tim Hildebrandt

The Secret of NIMH (1982)

Directed by Don Bluth

with the scene and before the crew would move to the next set-up, I would yell, “Hot frame and a cube!”

The AD, anxious to move on to the next scene, would roll his eyes as one of the cubes would be placed in front of the camera, leveled, and the camera would roll a few overexposed frames. But I knew that this might make or break the ability to have the background artists create “believable” backgrounds in perfect perspective for the film.

In post-production, Jesse Silver and I took on the job of laying out the backgrounds for the background artists. It was a monumental task considering that there were about 800 backgrounds to be produced in about six months. Luckily the process was rather straightforward. When the 65mm footage of the chosen take was made into 16 x 20” B/W Kodaliths one of the “hot frames with a cube” was included in the package of Kodaliths to be selectively rotoscoped and re-photographed with color gels (also including a 16 x 20” Ektachrome of the newly created background) on an animation stand. I had my other responsibilities during the day and would join Jesse in one of the trailers pulled onto the Disney backlot at night, and we would work late into the night drawing out backgrounds on animation paper with notes for the artists. It was pretty grueling work, but one of the things of which I am most proud on this film was how perfectly the backgrounds “fit” into the film. Not that it makes any difference to the audience or the critics, it’s just a point of pride.

Bill Perkins encountered comparable problems when computer-modeled objects and props first had to be integrated with hand-drawn characters on a Disney animated feature:

On *Oliver & Company*, some of the buildings and cars were modeled and animated in the computer. I think General Motors actually gave us some wireframes of their cars. But the Layout Department needed to draw the streets these CG cars would be driving on and we didn’t know what measurement or field of view we were drawing. So it came to the question of, “Well, OK, how do you do these things?”

We had a couple of meetings with the newly formed Digital Department at that time, which included Tina Price and a couple other people, and they suggested printing out a bunch of computer grids; at first we were thinking, “Oh, OK,” but then we started realizing, “Well, wait a minute, that means that we’re going to be drawing to a mechanical perspective—but how are we going to get the emotion and the expression into a scene if we’re locked to that?”

Having asked ourselves, “OK, how can this process be visually driven?” we took the *TRON* box concept and experimented with it: on one layer of the layout we would draw the New York street and then on a separate layer we would draw a cube that would match the make-believe perspective distortion. There was also a digital cube, modeled in 3D so the hand-drawn cube layer would then be scanned in so they could take the CG model cube, position it in the 3D world, and then change the field of view to get the same rate of convergence on the cube. If they did that, we could match up the field of view with our hand-drawn perspective.

THREE DIFFERENT VISUAL LANGUAGES

In the early days of computerized production, the Layout Department, perhaps more than any other, not only had to act as a buffer between one stage of production and another, it also had to



absorb the impact each time the old and the new worlds collided in some new way. Far from solving the old problems of perspective, Bill Perkins discovered that the digital toolkit unearthed entirely new ones:

Oliver & Company was our first dip into understanding that drawn perspective doesn’t match camera lens optics. There’s not a measurable, determinable relationship. At the same time, 3D computer space is not the same thing as drawn perspective, so there isn’t anything mathematically that you can guarantee will work between those two processes. And the camera optics don’t match either, so you’ve got three different visual “languages.” From Layout’s standpoint, it was very important to understand that.

We were really kind of hammering this out because when CAPS came along we had the digital composite, which was a 2D composite, then we had 3D components coming in that didn’t match the 2D composite, and if we drew it with “accurate” perspective, it didn’t match anyway! So we used digital perspective to fix our drawings, but we didn’t start with it because it didn’t give us the dramatic expression of the hand-drawn artwork.

“HUNT THINGS OUT, DISCOVER THINGS”

Two particular traditional layout artists, Roy Naisbitt and Don Bluth, are repeatedly cited by their peers as being masters of dramatic perspective. Bluth famously left Disney in the early 1980s following a period that, as John Musker described it, had seen something of a downturn in the scope and ambition of layout design:

I think what happened in the '60s and '70s was that layout really atrophied and the great layouts of the past, and the filmmaking ideas, got sacrificed. Some animators were even doing their own layouts. They would become sequence directors, and because they didn't think so cinematically, they would design things that would be easier to draw. In the lighting and the mood it was almost like they lit everything up, following the idea that comedy needs to be played in the light when, from the storytelling point of view, it might have been better to play things in silhouette, to understate things, or leave them in the deeper space so you have to hunt it out a little bit more and discover things.

Partly in reaction to this perceived atrophy, Don Bluth left Disney to direct his own features, starting with *The Secret of NIMH*, in 1982. This in itself forced him into a new relationship with layout and a reevaluation of all he himself had learned from the great Disney artists:

When I became a director and I had to critique the work on a production, I would look at the layouts and think back to Don Griffith, and if I found myself saying, “No, these aren't taking my breath away,” I would begin, just on my own, to analyze exactly what makes a good layout, what makes it feel good? And I came to the conclusion that that flat piece of paper you're drawing on should be considered a cube and not “flat” at all; you're

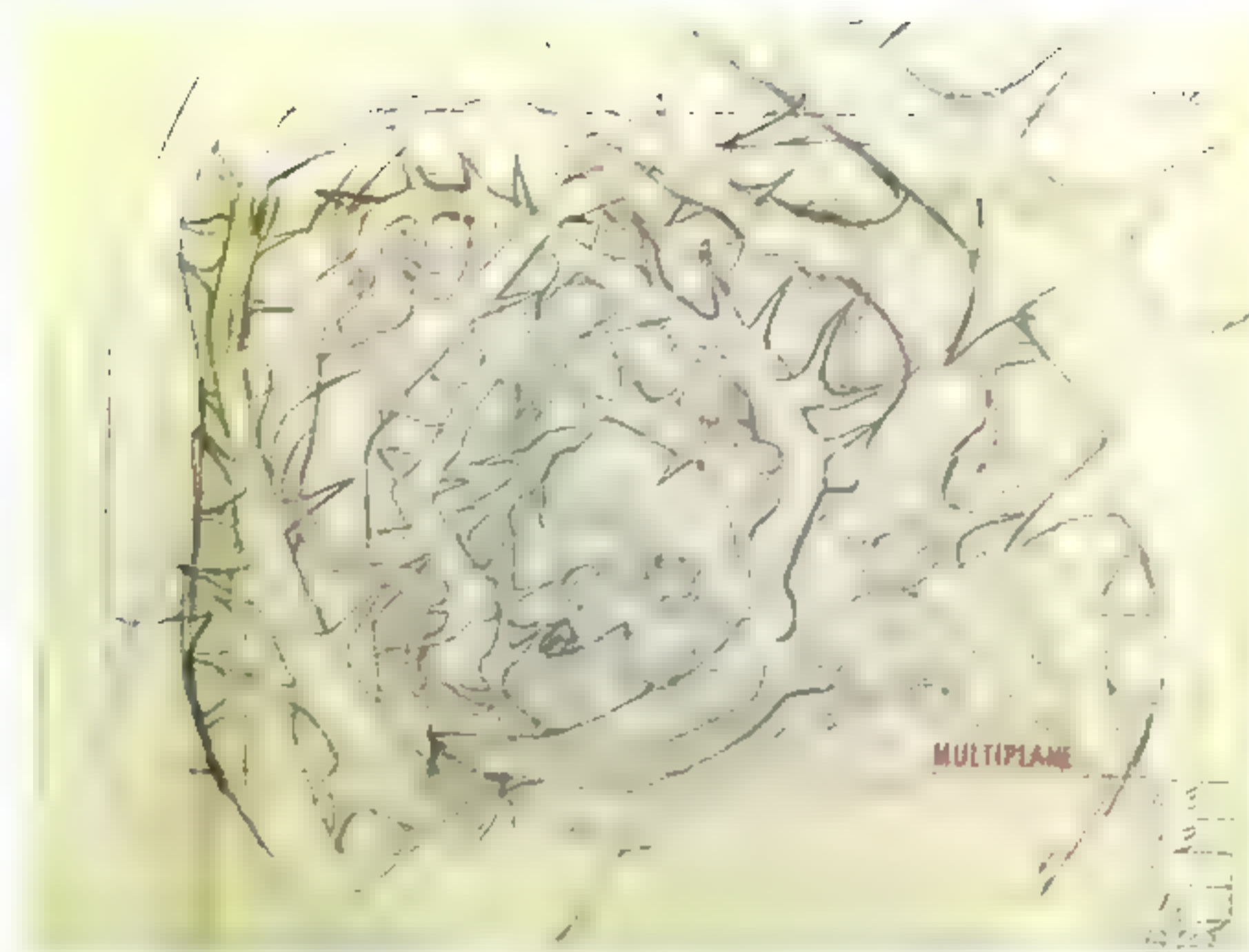
carving something that goes dimensionally back into the paper. It's a dimension.

Larry Leker, head of layout on *NIMH*, still looks to both Bluth and Naisbitt for inspiration, admiring their ability to think and design in this dramatically dimensional way. Facing serious competition from other studios for the first time in a marketplace that Disney itself had created, the studio eventually turned to artists like Leker:

Since I had no art school training, my influences when I started in animation were pretty much from live-action. In terms of layout I decried the inability to move the camera. The first thing I discovered when I started working for Don was the limitation of 2D animation and the frustration of having to stage everything on a flat piece of artwork, so I immediately started practicing distortion.

One of the reasons Disney became interested in me after I worked for Don was because they knew that Don had a sophistication with 2D that allowed him to give the illusion of 3-dimensional space that very few people in America were doing. The one person who was doing it to a greater extent than Don was Richard Williams on the Roger Rabbit “Maroon Cartoon” short *Somethin's Cookin'*. That short gave the illusion of 3D backgrounds through distortion.

Roy Naisbitt's a brilliant man. In my opinion, he's a genius. What I gleaned from Don Bluth and what I then started to codify from *Somethin's Cookin'* was that you can get away with any degree of distortion if the distortion is not obvious within the fielding that you're showing to the camera.



OPPOSITE: Harsh, menacing thorns give way to more rounded and inviting organic shapes as a series of subtle spiral compositions draws the audience deeper into Mrs. Brisby's miniature world.

Original background layout drawings

The Secret of NIMH (1982)

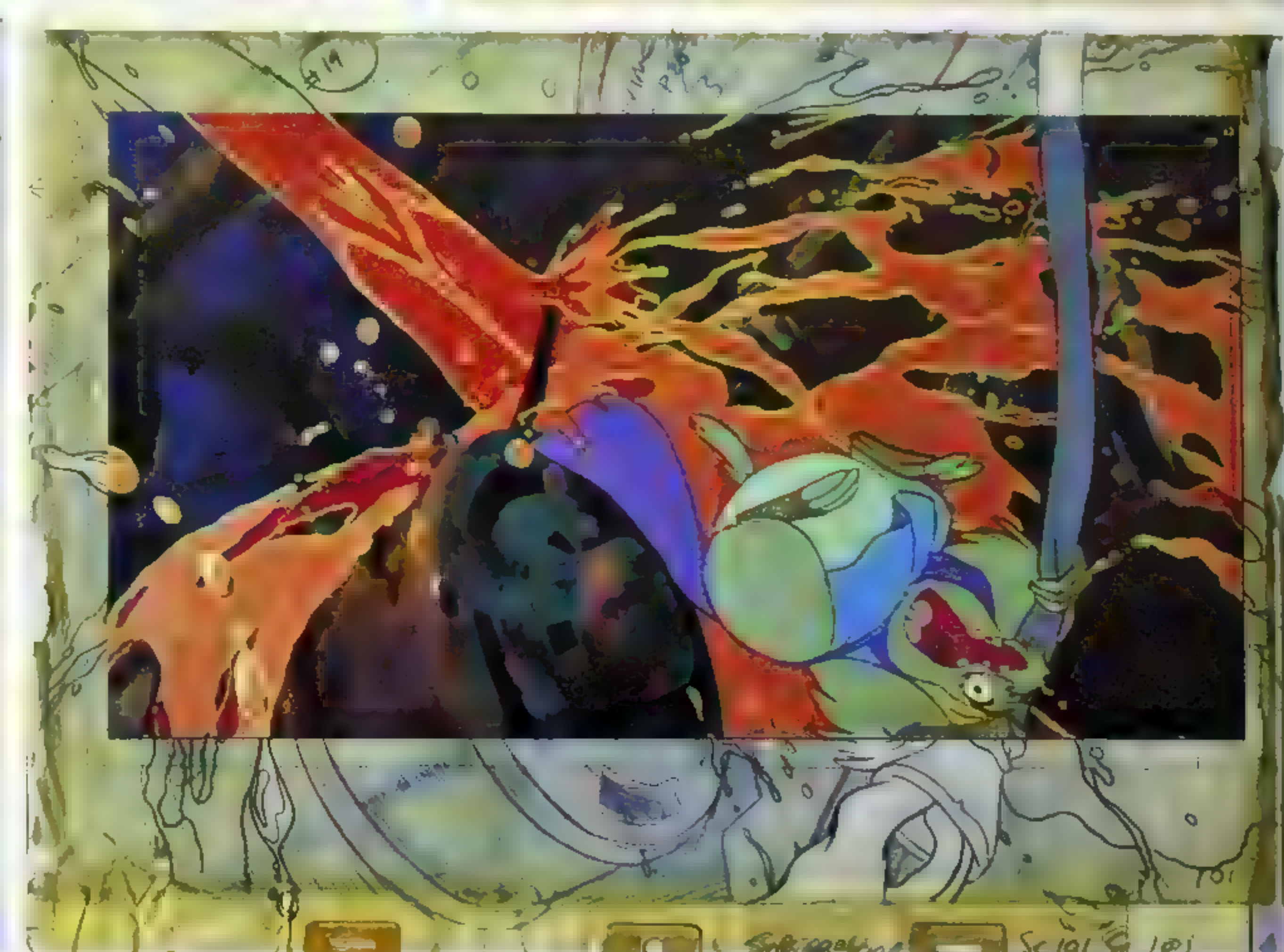
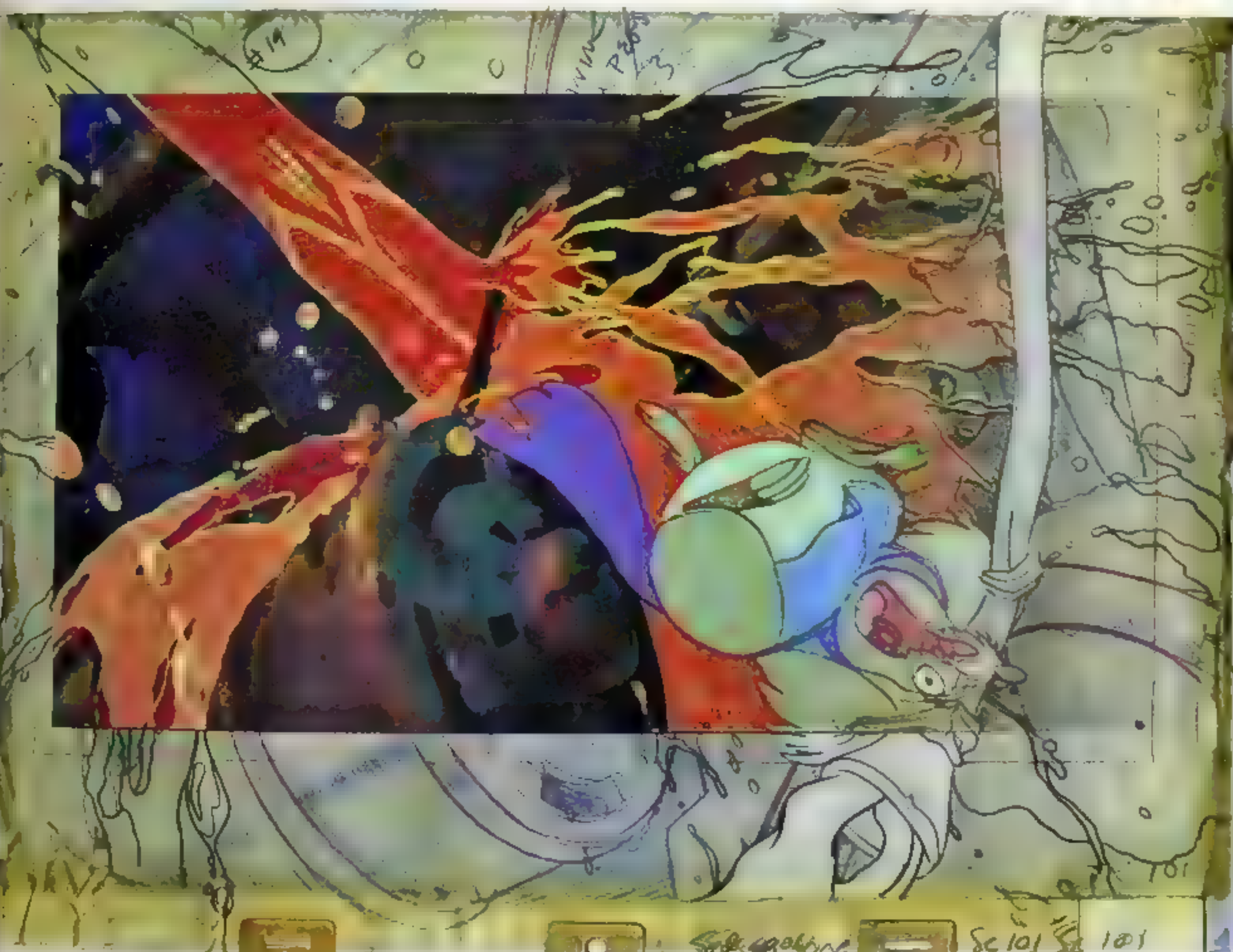
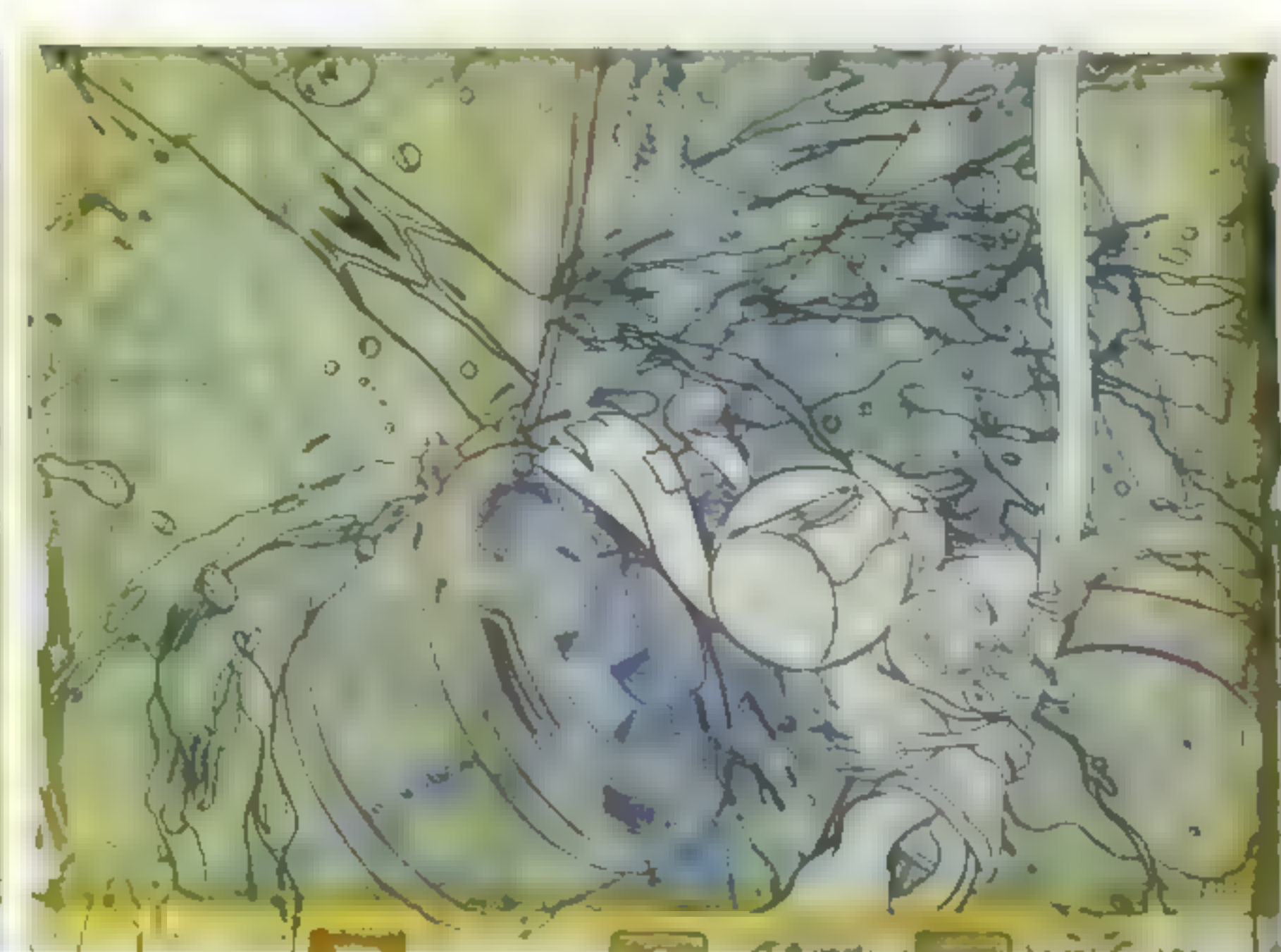
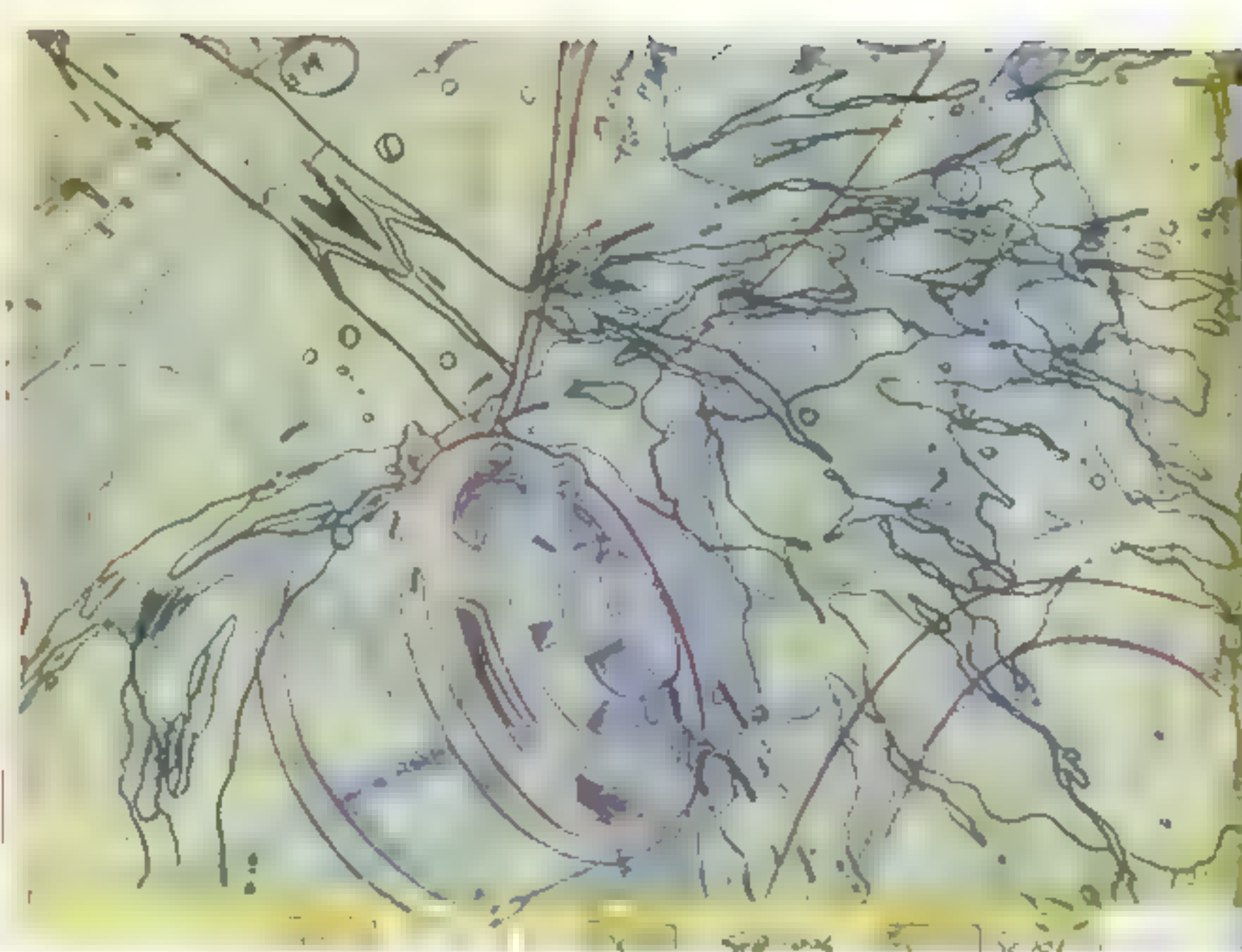
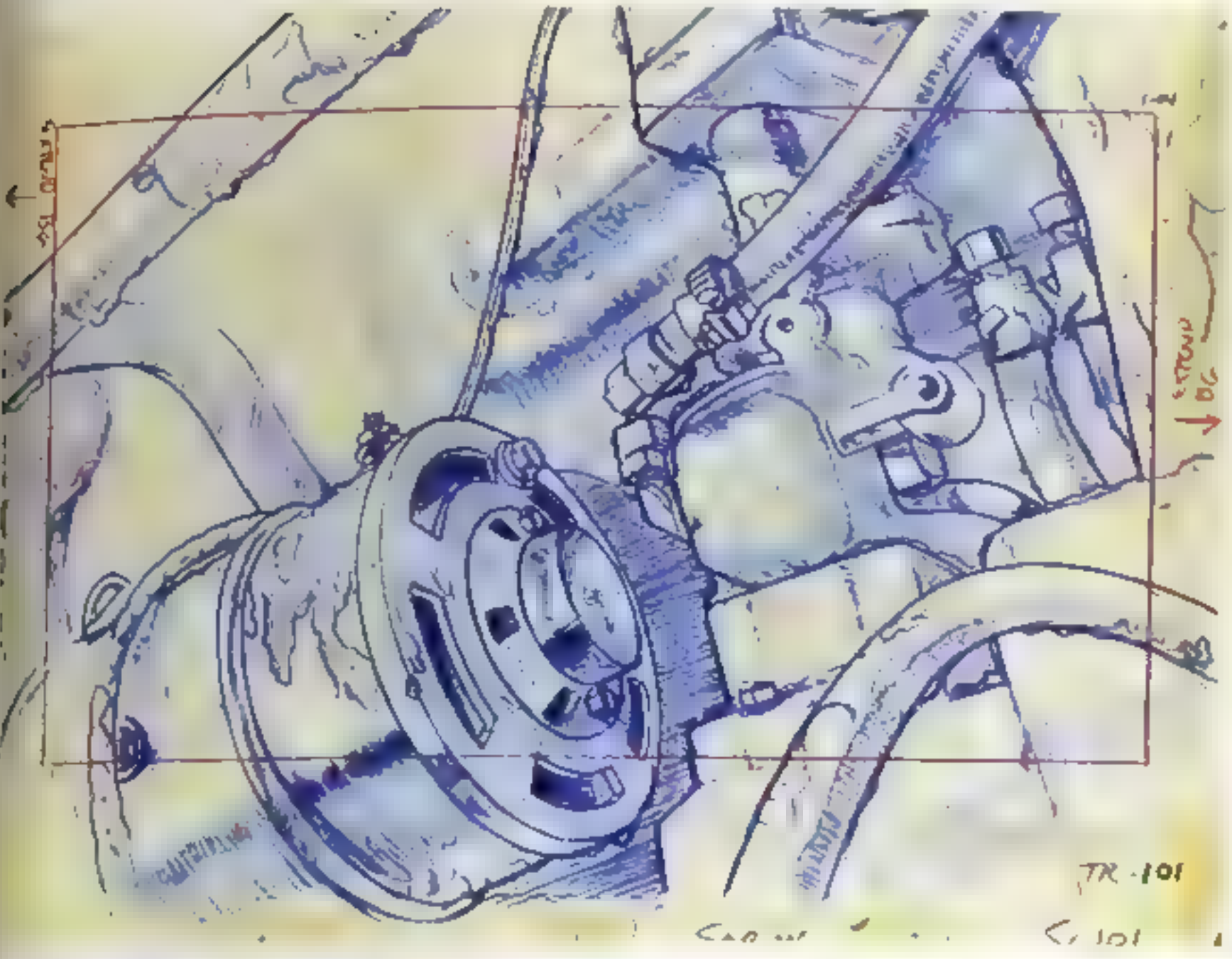
Directed by Don Bluth

BELOW: While an extraordinary level of detail is visible in any one still frame from *The Secret of NIMH*, the quality of the draftsmanship is always carefully offset by the simple geometry of both composition and framing. In this example the character continues to "read" clearly against a powerful diagonal, in spite of the complexity of the machinery and the line detail of the effects animation.

Original background layout drawings plus character and effects levels seen over frame enlargement

The Secret of NIMH (1982)

Directed by Don Bluth



TOP. Layout artist and supervising art director Roy Naisbitt examines a selection of his own designs and Errolle Cain's painted backgrounds for the "War Machine" sequence in Richard Williams's *The Thief and the Cobbler*.

The Thief and the Cobbler (1993)
Directed by Richard Williams

BOTTOM. This diagram explains how the different levels of flat artwork need to be moved on the sliding peg bars of the compound table to achieve a pivoting "point-of-view" effect; though the film plane within the camera body will remain parallel at all times to the artwork on the table beneath the lens, the final effect will be that of the Thief's view as he tilts his head back to look up at the giant ruby mounted on the forehead of a gigantic gold statue, encircled by armed guards.

The Thief and the Cobbler (1993)
Directed by Richard Williams

A TREMENDOUS UNDERSTANDING OF HOW THINGS ARE PUT TOGETHER

John Leatherbarrow, who photographed *Some-thin's Cookin'* and was also in charge of a section of the London animation crew on *Space Jam*, still considers the *Some-thin's Cookin'* sequence to be one of the highlights of his career:

I've been in the business so long now and there's lots of things that I've done that I'm quite pleased about, but that opening sequence to *Roger Rabbit*, the "Maroon Cartoon," is something that I'm particularly proud of. Dick and Chris [Knott] and I were given free rein on that to a certain extent, it was kind of our own little project in a way, done in The Forum,⁷ in Camden as sort of an in-house thing; the light and the color and Roy's perspectives, Chris's effects and all that. We were just given the ball and told to run with it—and we did!

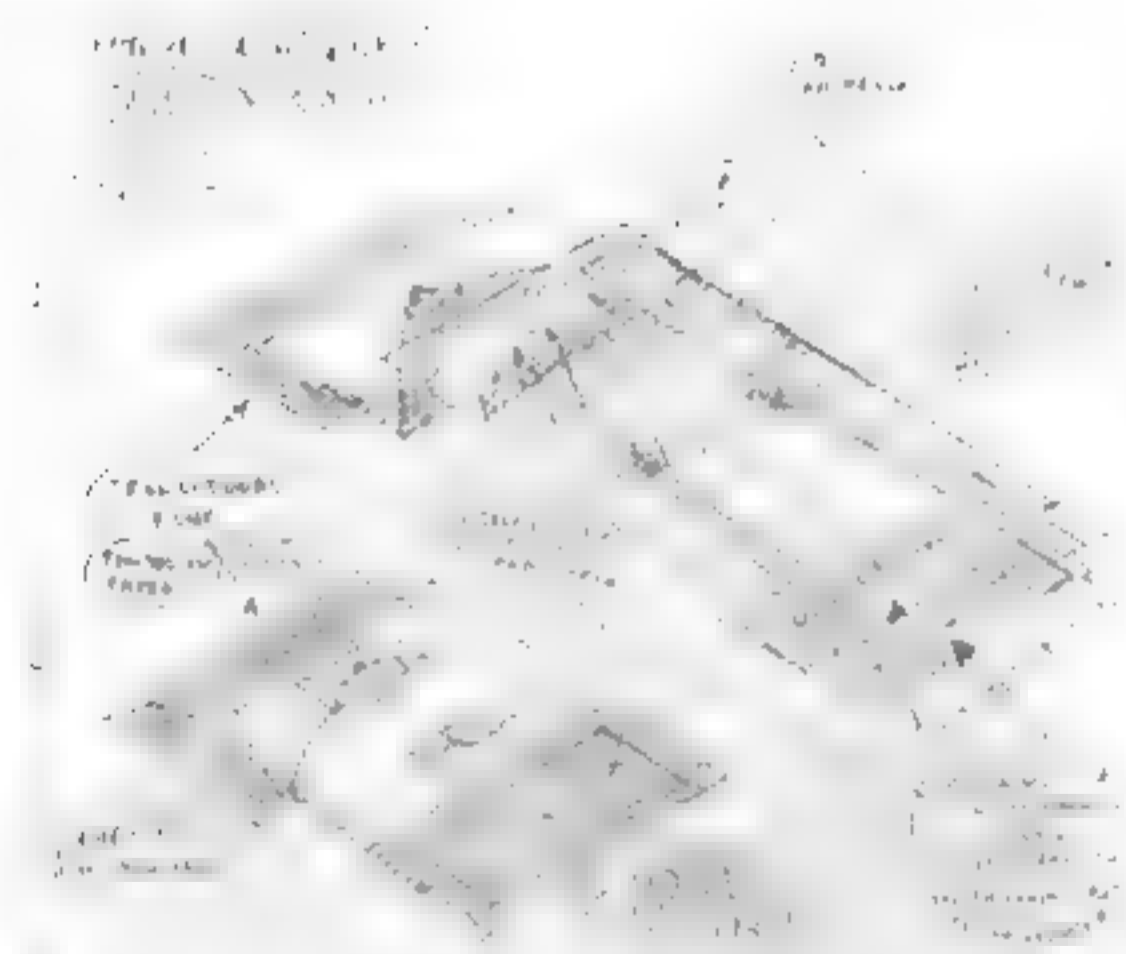
Following the success of *Roger Rabbit*, work resumed on the animated feature project that Williams had been working on in one form or another for over twenty years, *The Thief and the Cobbler*. Although it meant a return to "pure" hand-drawn animation without any troublesome live-action components, the practical, creative, and organizational challenges were just as great. As Leatherbarrow explained:

We were doing such complex things on *The Thief* with Roy and the Camera Department, it was unbelievable. We had backgrounds like rolls of wallpaper. We literally had to stick them to the walls and move them across. We did everything. We had bi-pack,⁸ multiplaning, and mattes. It's complex work, but that gives you a tremendous understanding of how things are put together. In a way, that is layout. Layouts can be just for backgrounds—they can be as simple as that—but the



other side of layout is giving direction for the camera, instructions for the moves. And with some of the things we were doing, you had to understand how it originated and how it was going to end because you were somewhere in the middle. So if you didn't understand both sides of it—recipe for disaster!

Roy and I and the editor, Peter Bond, were forever in the cutting room and forever at meetings asking people, "What's happening? What are you doing?" We had to do that. We had to be involved in the whole process. Apart from the animation itself being tremendous, my remit was to make it look good while it was happening.



The original "War Machine" sequence from *The Thief and the Cobbler* included this complicated, multilevel shot of spiked metal balls pouring down a spiral chute. Roy Naisbitt's original diagram explains in detail how the various animated and scenic levels are to be created and how the completed artwork is to be photographed using a combination of vertical and diagonal sliding peg bars.

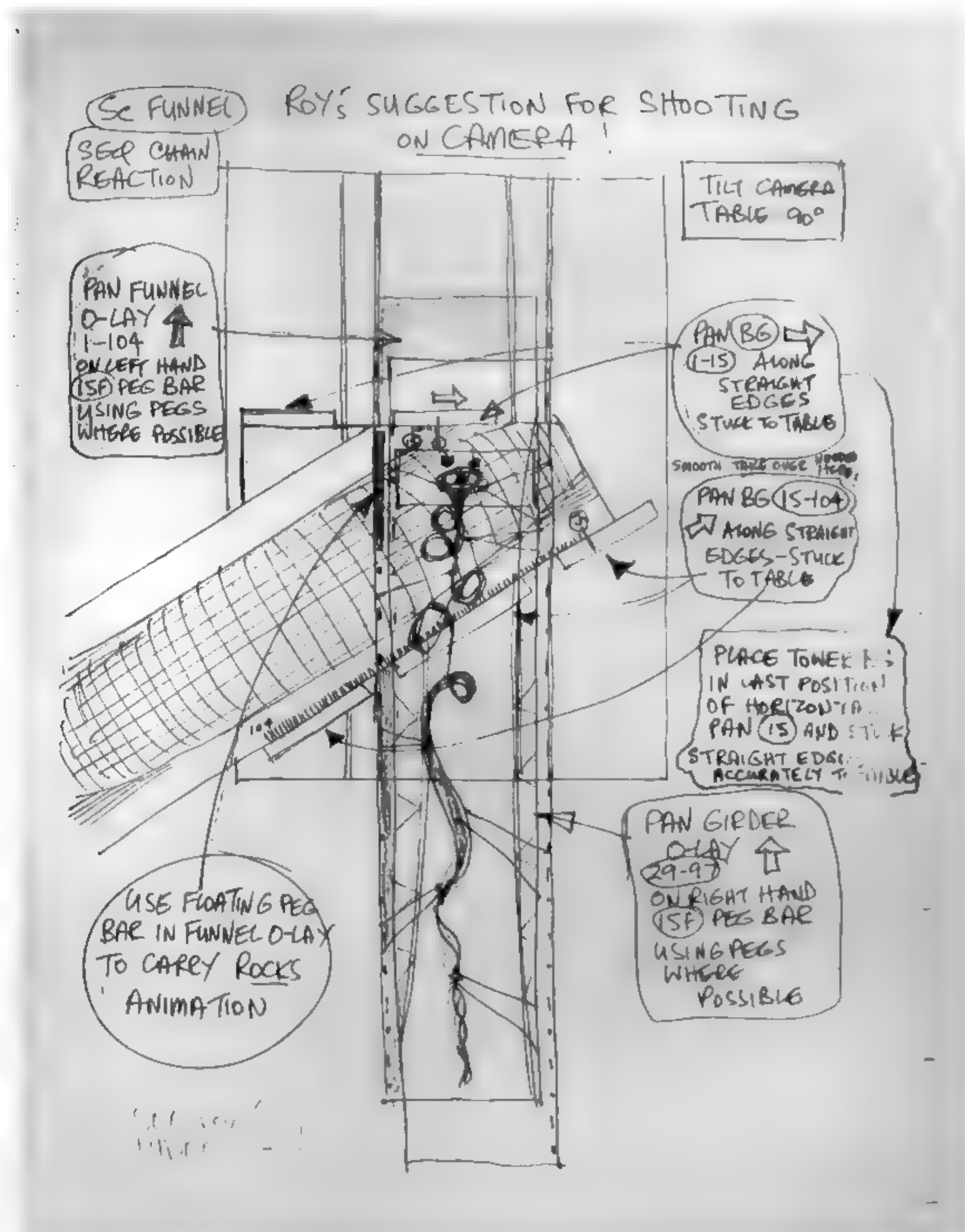
The Thief and the Cobbler (1993)
Directed by Richard Williams

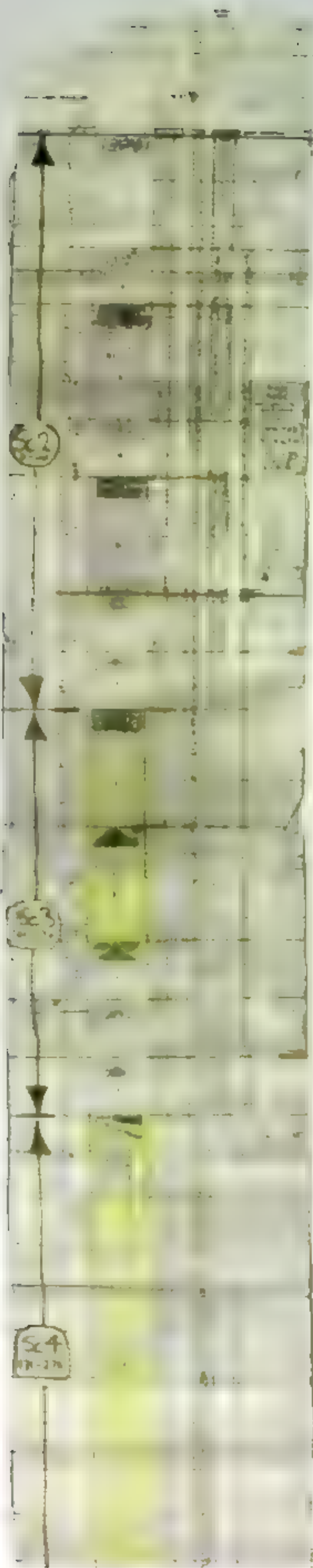
"I JUST LOOKED AT THE SKY AND SAID, 'YEAH...!'"

For all that animation might be based on artifice, illusion, and caricature, its impact on an audience derives in no small part from careful observation of the physics, conditions, and events that surround us in the real world. Perhaps the best illustration of this point also came from my conversation with John about his memories of working on *The Thief*:

I was struggling a bit with one scene where the thief was on his pole, jumping up and down. We were having trouble getting the sky to look right, getting it to look atmospheric to fit in with the mood of the scene. I was down shooting one day; I was really tired and Dick Williams came charging down, bashed in to the camera room, grabbed me by the scruff of my shirt, dragged me through, opened the door, shoved me out, and said, "Look!!" And he pointed my head up and said, "That's what I want!" And I just looked at the sky and said, "Yeah, OK," and immediately I knew what he meant! But that's how he communicated it.

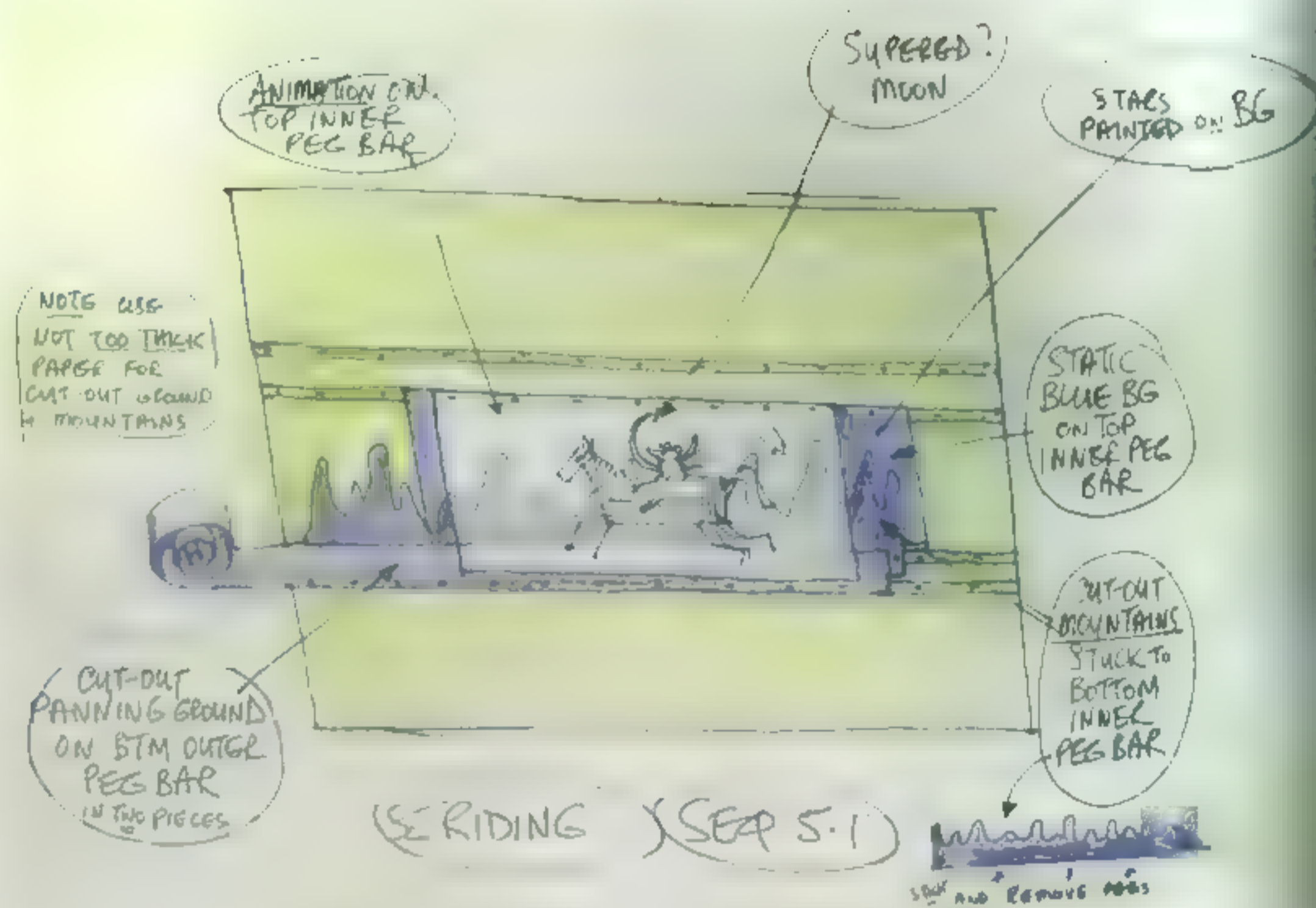
It's got to be convincing and you've got to look around. I know animators that just draw! That's all they do. But I know other animators, particularly the good ones, that are *looking* all the time. When someone walks down the road, they're studying it. And in my still photography, even as I'm looking out the window, I'm thinking, looking at the colors and the shapes. Because if you don't do that, you just become a technician, you just perform a function. But I can't help looking around and studying things! Because once you see, once you know what people are looking at and what people like and what looks good, you can learn how to give it to an audience or a director.





LEFT An exposure sheet from *The Thief and the Cobbler* explaining how one of the scenes is to be photographed, starting with a close-up of the interior of King Nod's mouth and rapidly pulling back to reveal the entire Golden City. A phonetic breakdown of the dialogue line, "My kingdom will come to destruction again...!" is included in the left-hand column as a guide for the character animation team, which has to synchronize the king's mouth movements to the individual vowels and consonants of the prerecorded audio track. Tiny photocopied thumbnail sketches of the successive key camera positions have also been pasted in to the X-sheet to help the camera operator calculate where the incremental "notches" will need to be marked on the tower of the camera stand, guiding the key placements of the camera body throughout the rapid "pullout."

RIGHT. Frame enlargements from the finished scene.
The Thief and the Cobbler (1993)
 Directed by Richard Williams



OPPOSITE BOTTOMRIGHT In an echo of both Ub Iwerks's *Headless Horseman* and Disney's *Parallax Moon* demonstration sequence for the original multiplane camera, a lone scout, mortally wounded, makes his way on horseback to warn the inhabitants of the Golden City that the One Eye army is approaching. Roy Naisbitt's original explanatory sketch indicates how each individual element needs to be created, peg-registered, and moved incrementally across the compound table of the rostrum camera to achieve the desired effects of depth and perspective—without resorting to a more complicated and expensive multiplane camera set-up.

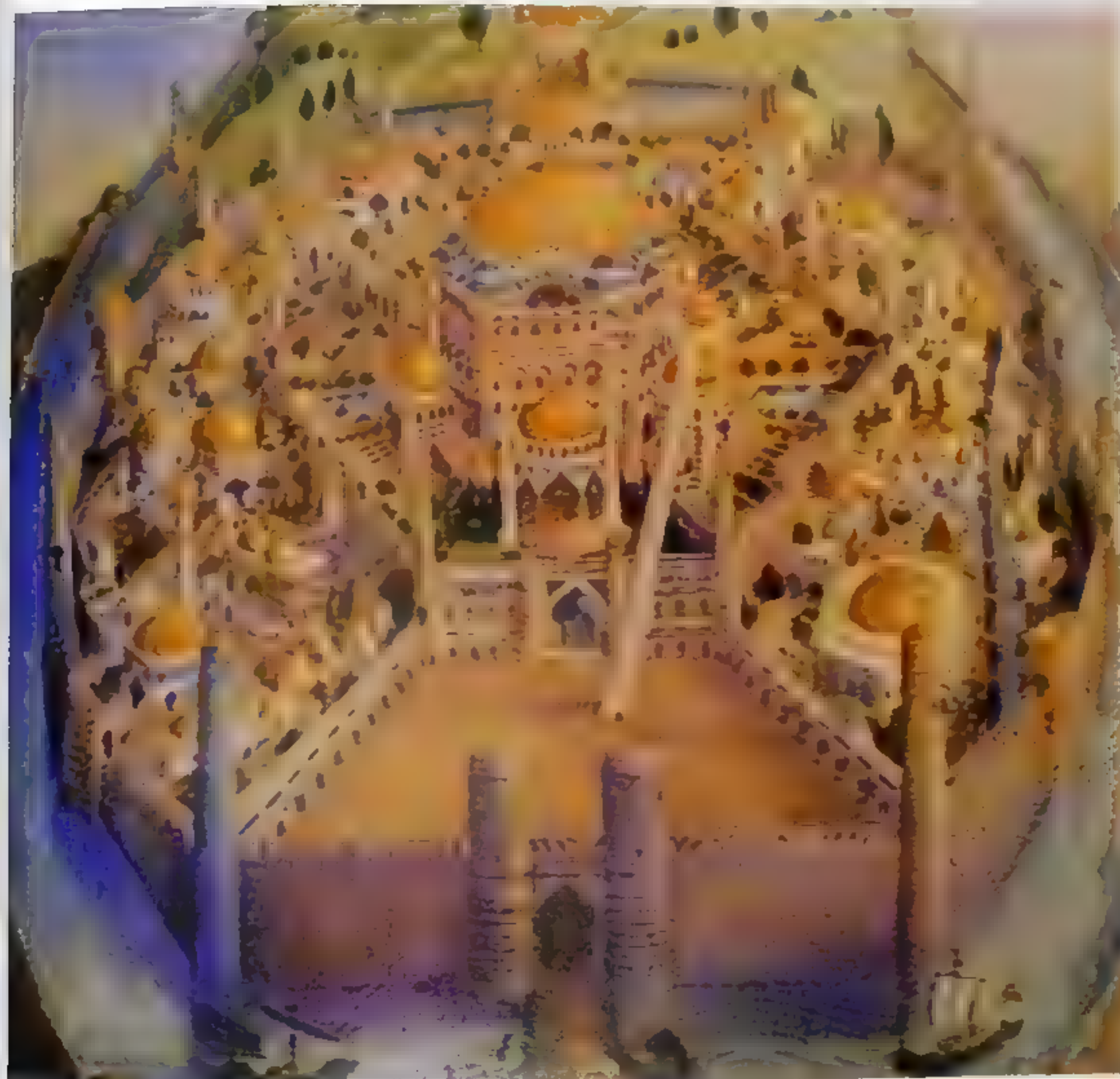
Sketch by Roy Naisbitt
The Thief and the Cobbler (1993)
 Directed by Richard Williams

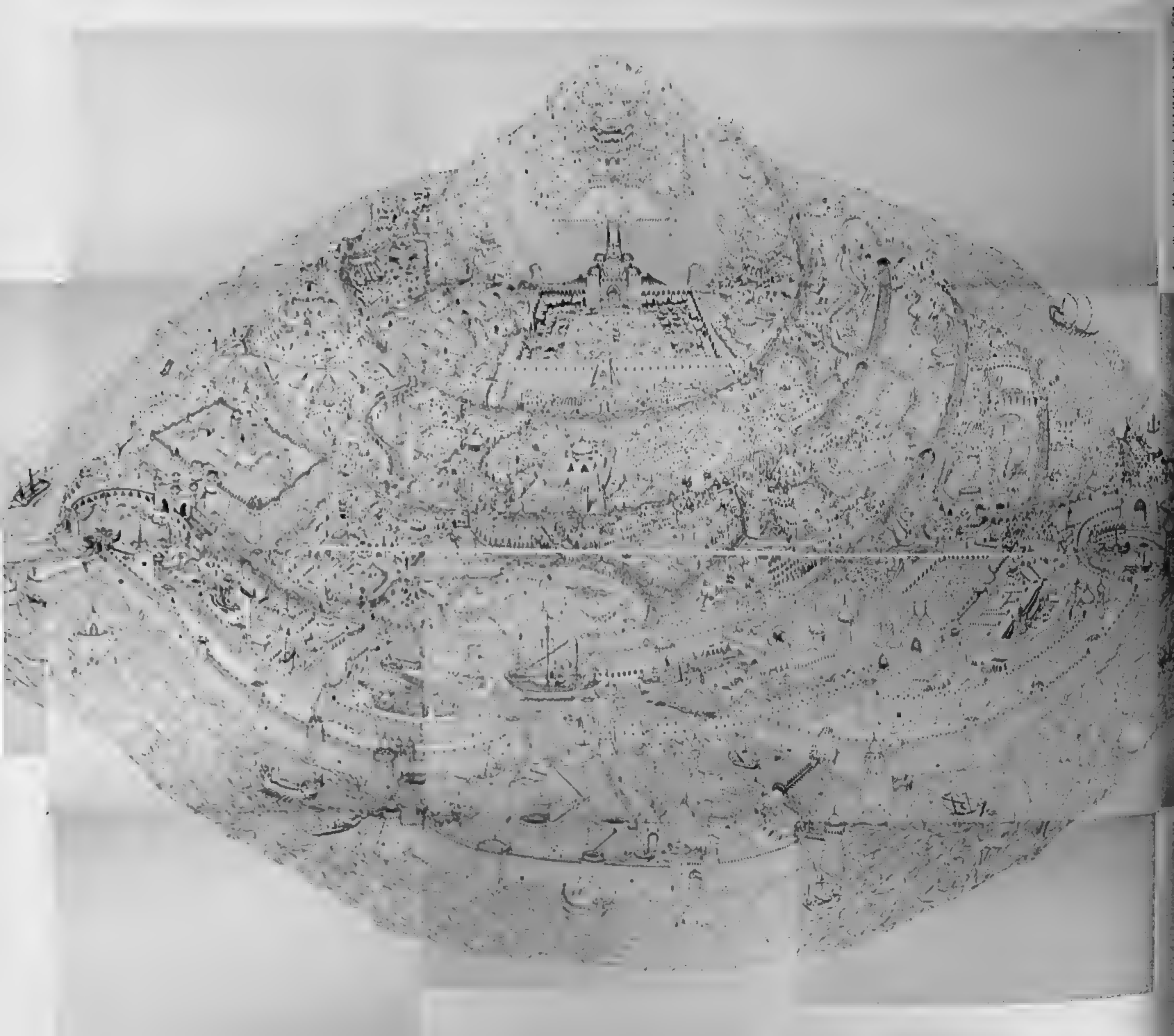
LEFT According to Roy Naisbitt, "Errol Le Cain had lived in the Far East and he used to sit on a chair, working away hour after hour after hour, as if he was a monk working on a manuscript. He designed some of the layouts and so did Dick Williams, but whenever I did anything Errol was very faithful to what I did—but he embellished them with all this terrific stuff."

Completed background painting of The Golden City by Errol Le Cain (from original ink layout drawing by Roy Naisbitt)
The Thief and the Cobbler (1993)
 Directed by Richard Williams

RIGHT, TOP. The checkered ground plane of a wide city street appears to "pour" toward the camera in this deliberately nonliteral perspective.
The Thief and the Cobbler (1993)
 Directed by Richard Williams

RIGHT, BOTTOM Roy Naisbitt holds up one of his sinuous, dream-like perspective designs for *The Last Belle*.
The Last Belle (2011) Hysteria Ltd.
 Directed by Noel Boyle
 Layout and background design by Roy Naisbitt





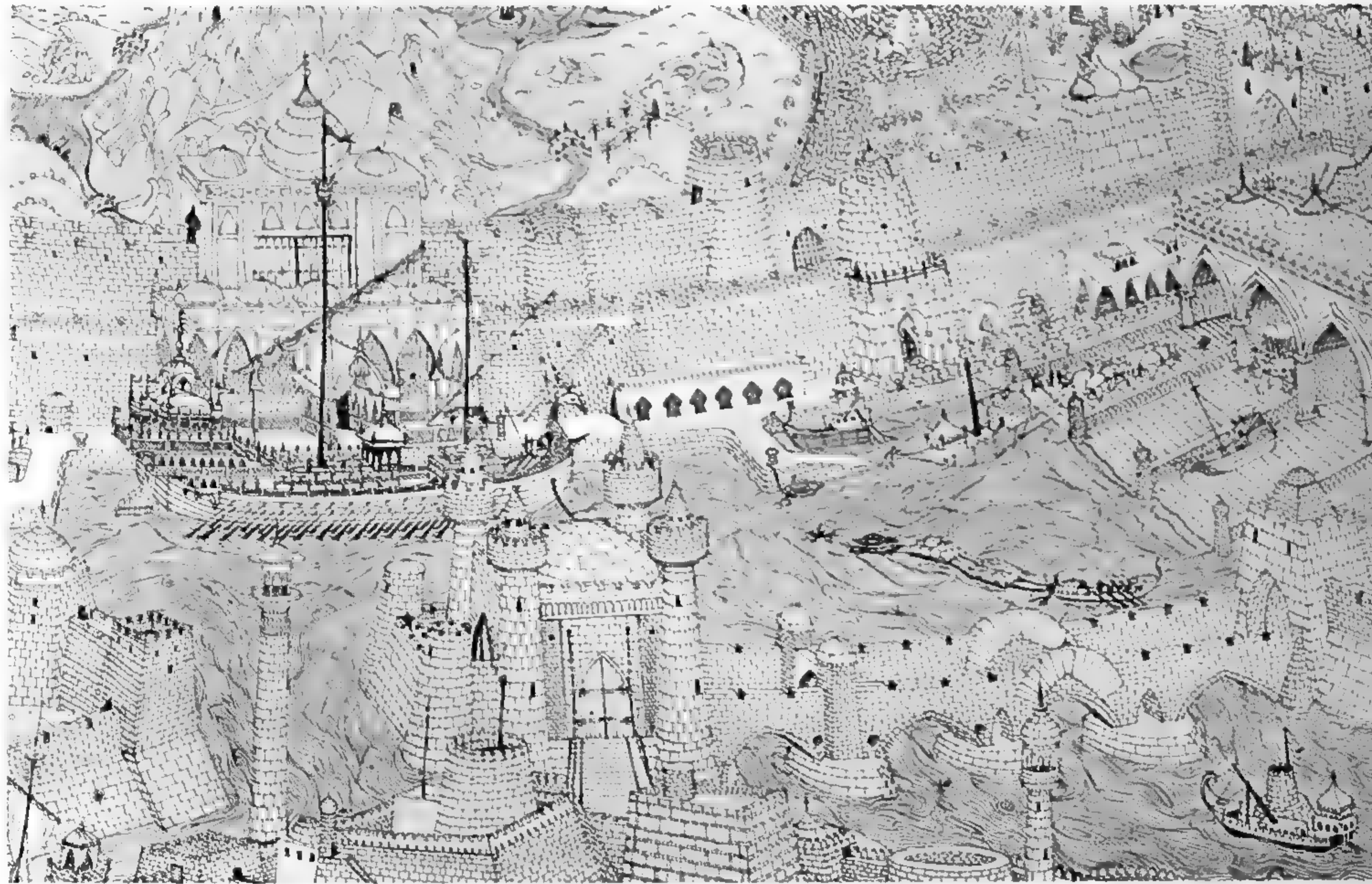
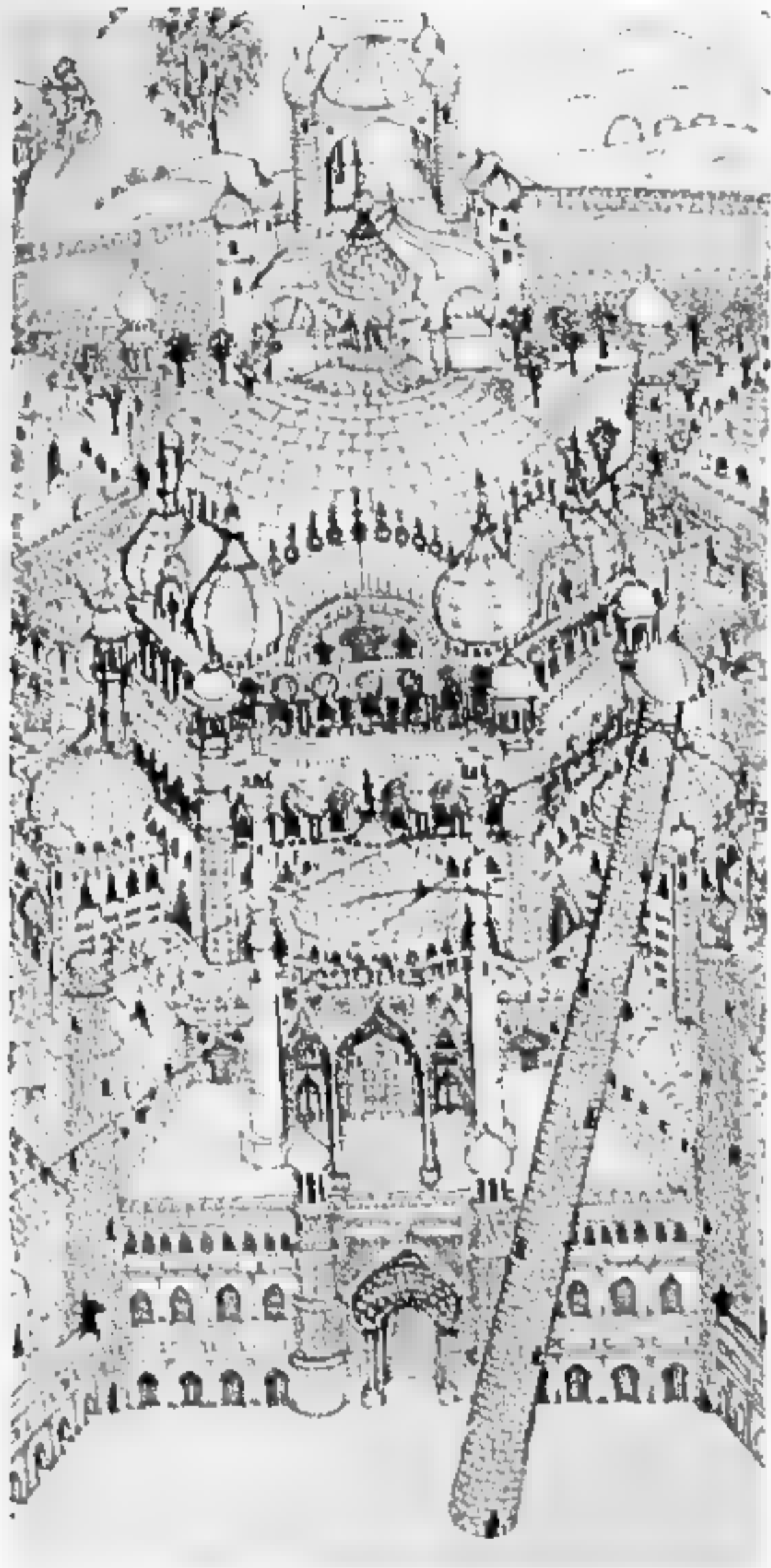
OPPOSITE: Six months of work—a combination of detailed observation, limitless imagination, and expert draftsmanship—went into this one drawing: Roy Naisbitt's design for the Golden City in Richard Williams's *The Thief and the Cobbler* (1993). As Naisbitt recalls, "Everybody worked so hard. Dick had the knack of finding people who would work endless hours. I think it's because of his talent, you see. If you were interested in the work you just had to stay there and do it, because it was a passion."

The Thief and the Cobbler (1993)

Directed by Richard Williams

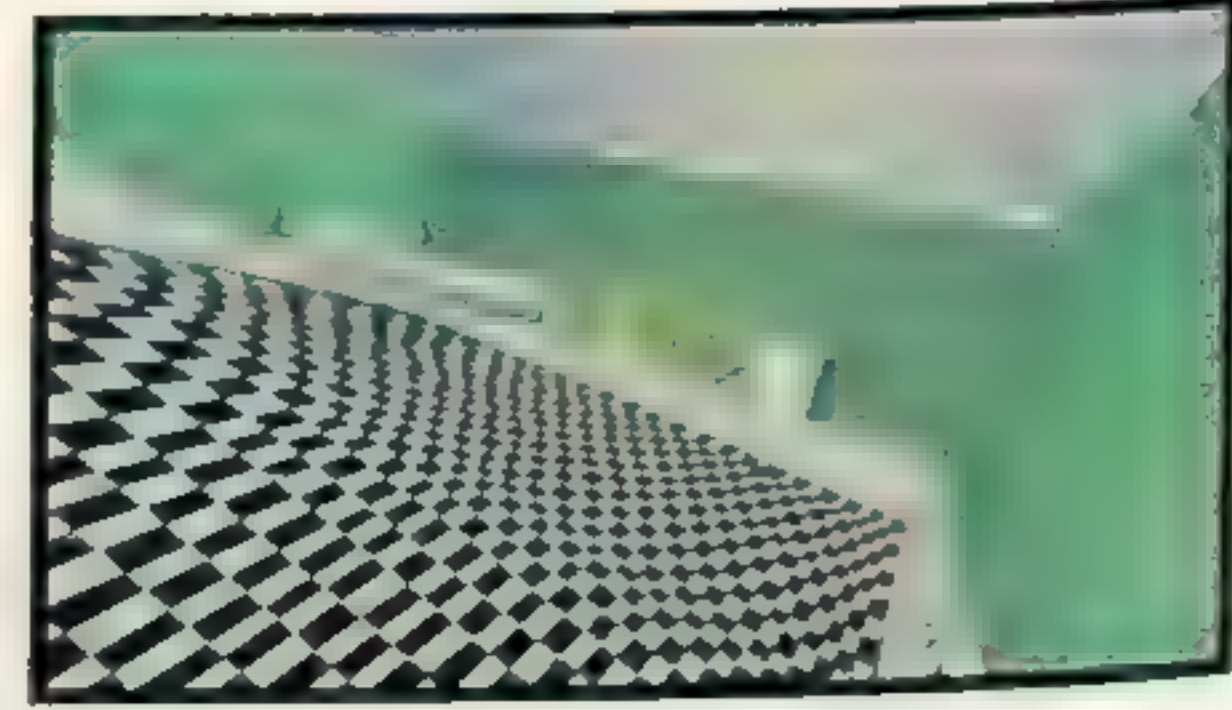
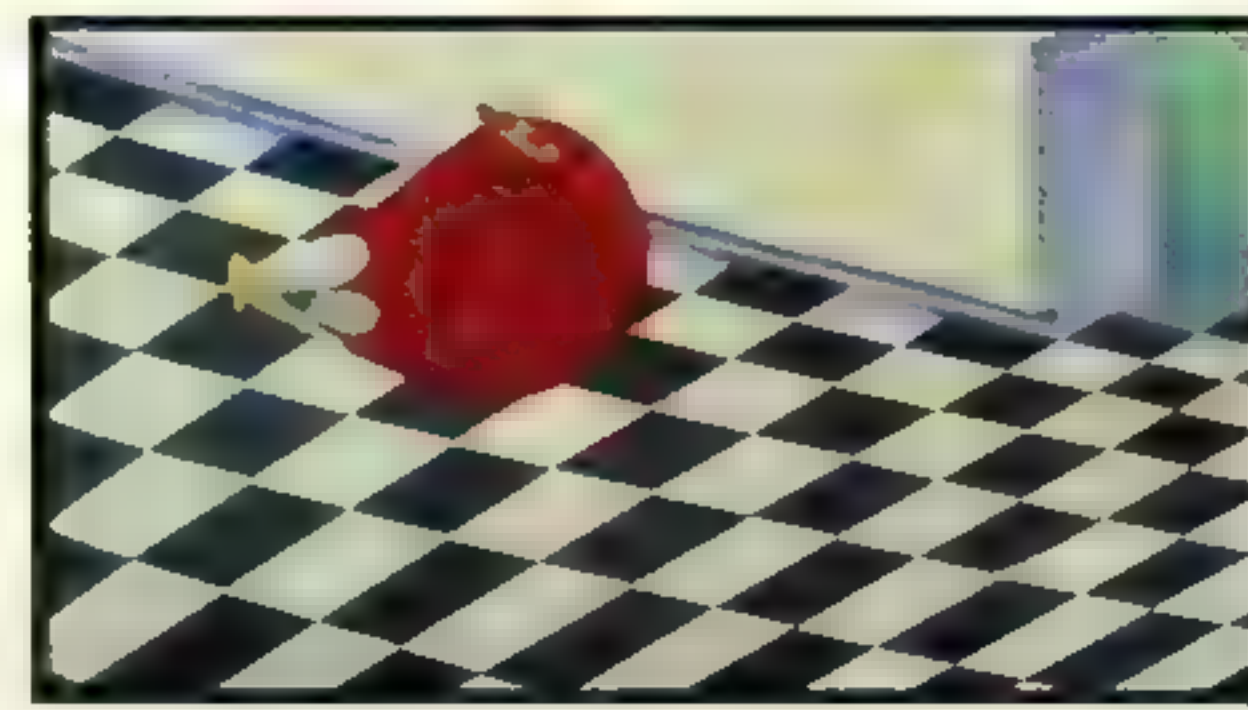
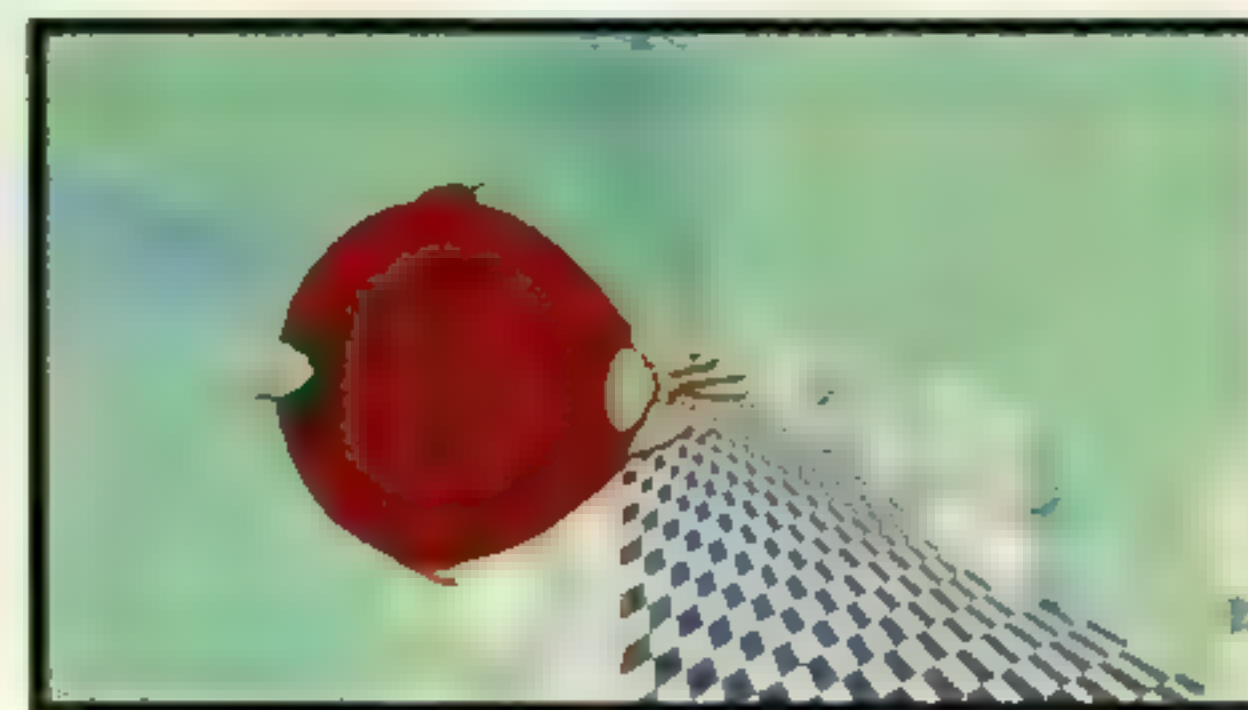
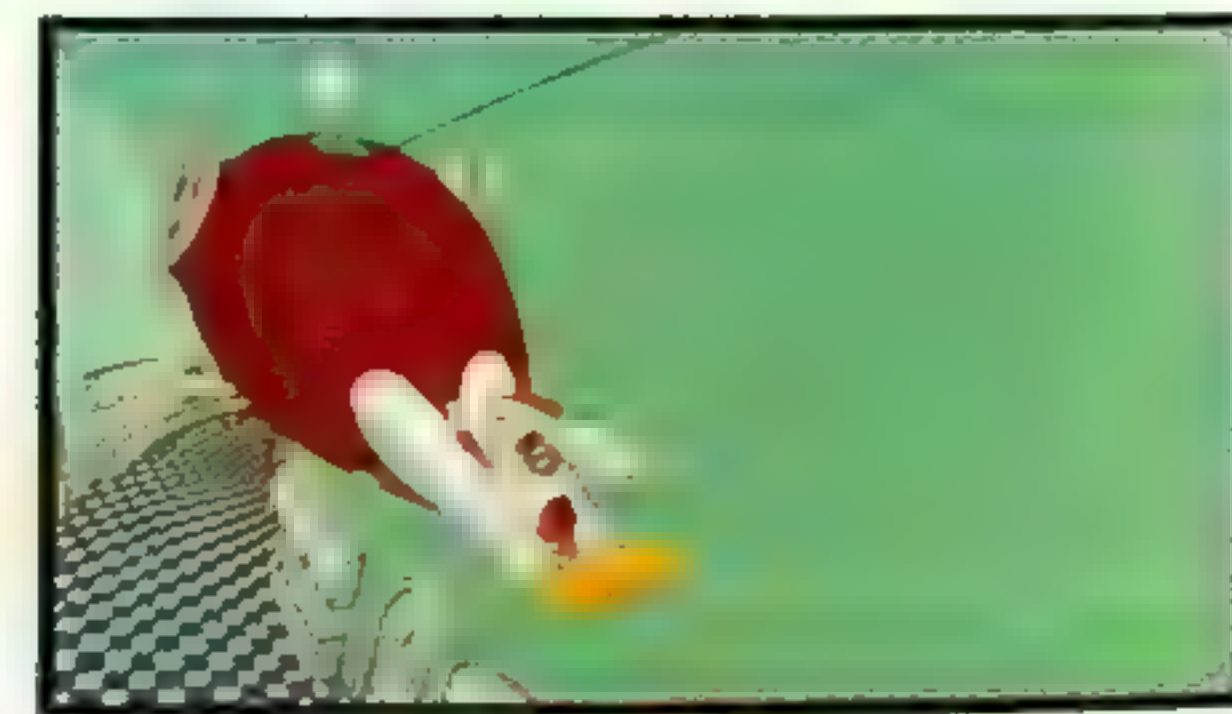
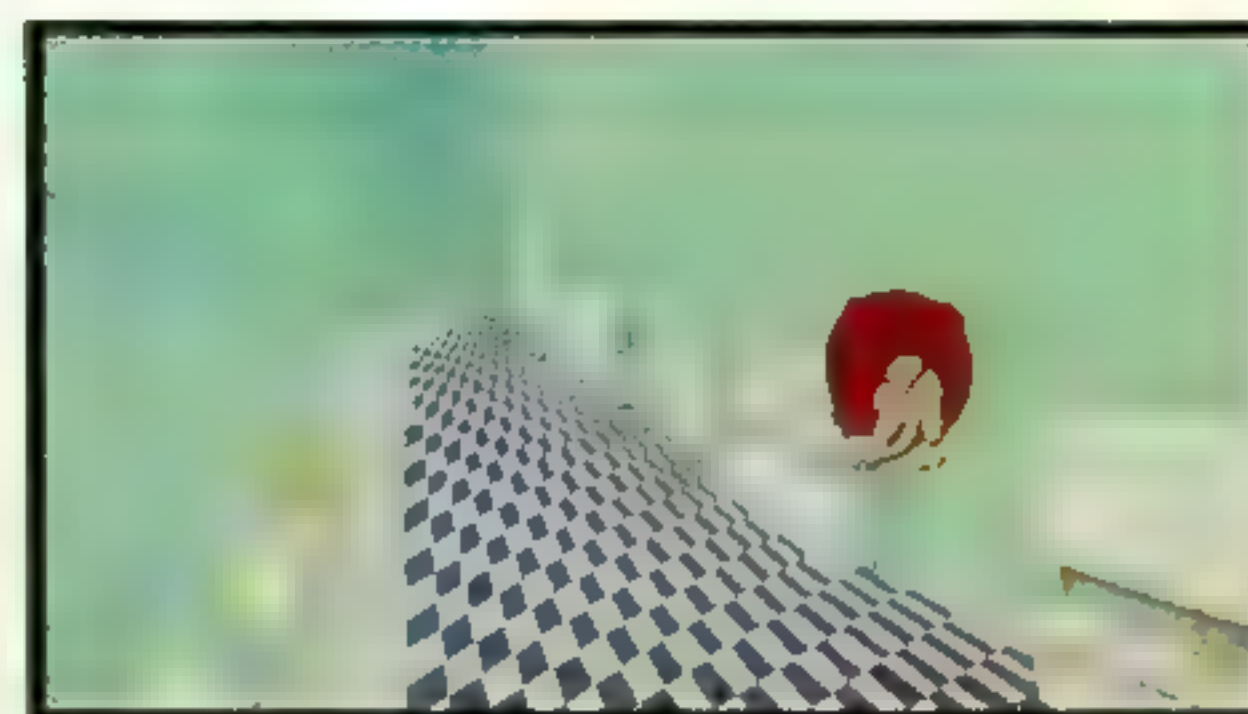
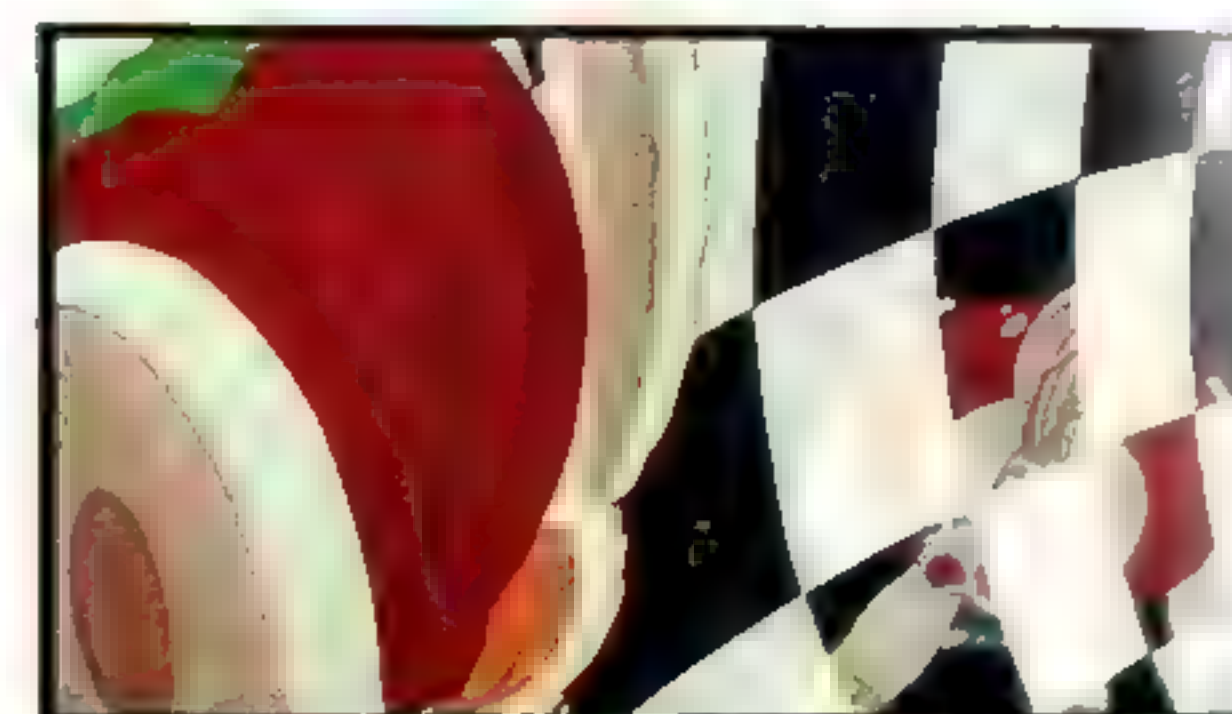
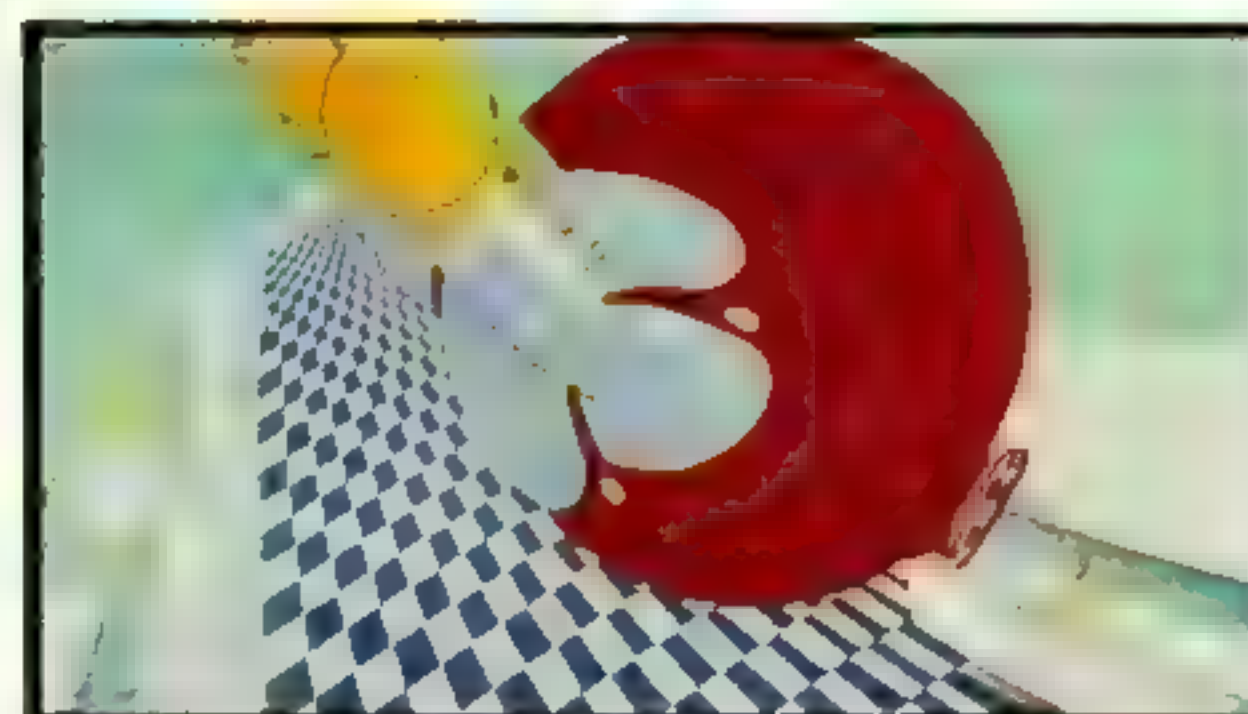
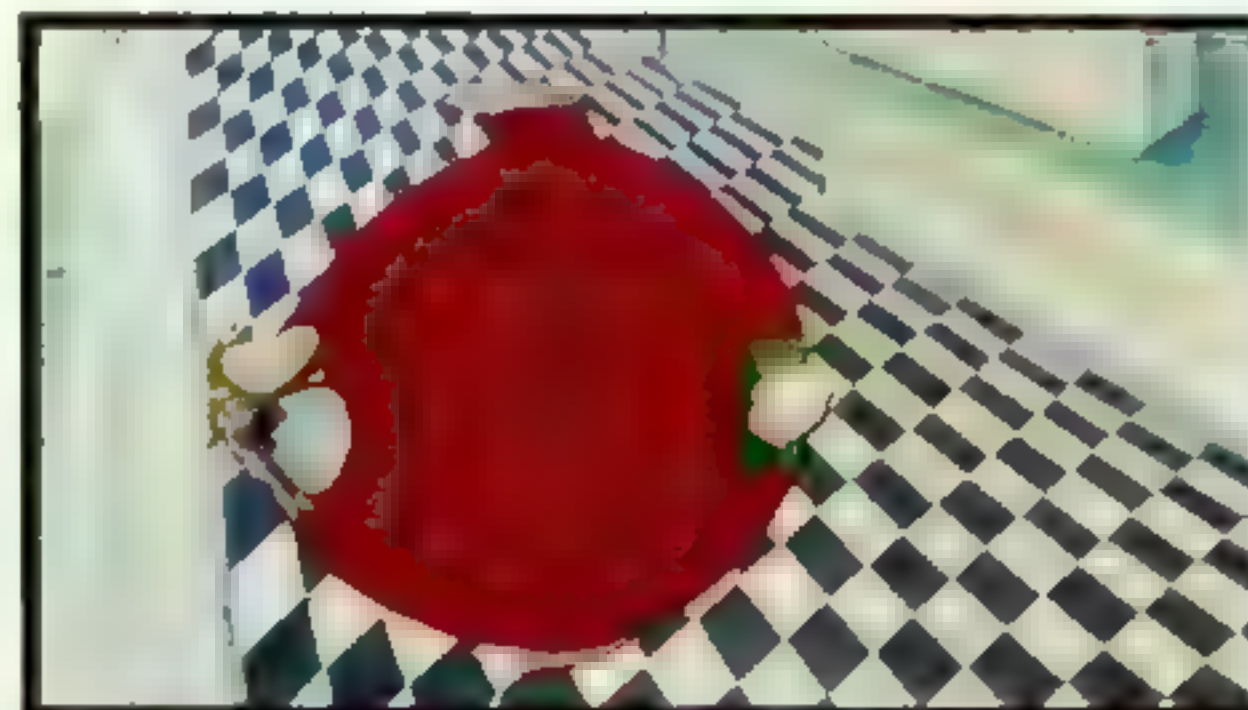
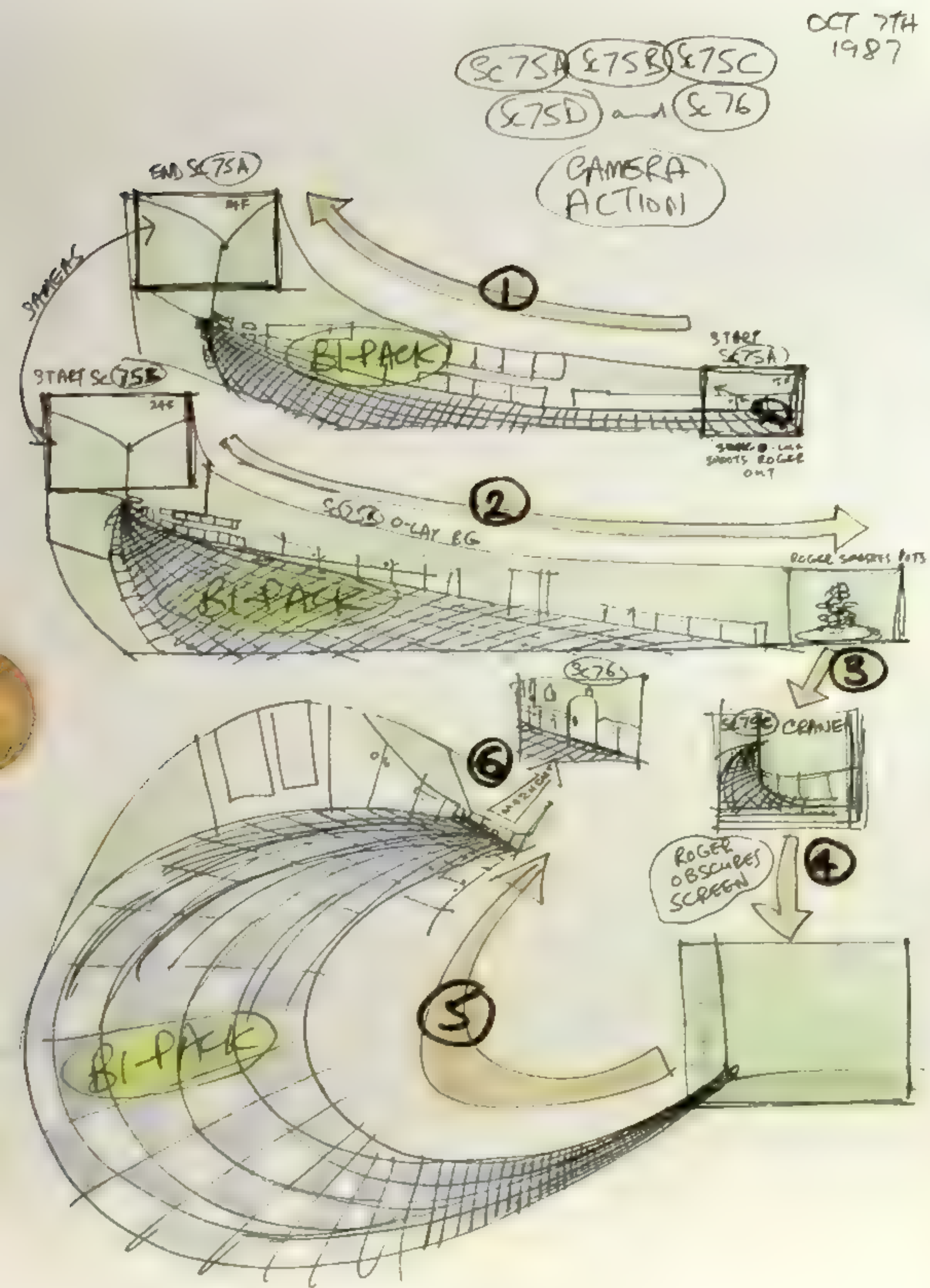
LEFT: Included as a minute detail in this immense cityscape, the Thief can just be seen, balanced precariously on one of the slender cables that support the tallest minaret in the city as he makes his way toward the legendary golden balls.

RIGHT: "Dick was a 100 percent 'Disney man' but he didn't want to do a 'Disney' kind of illustrative film; he wanted to do something different. He wanted to have not 'art' but optical illusion. And because it was based on Persian miniature paintings (and the Persian miniature artists) didn't bother with perspective, I tried to give the sense of perspective without following the rules of perspective. That was one of the challenges." (Roy Naisbitt)



LEFT: The first of two original diagrams drawn by Roy Naisbitt to explain to camera operator John Leatherbarrow how the various character, special effects, and background elements of Scene 75 from the opening "Maroon Cartoon" are to be photographed. *Who Framed Roger Rabbit* (1988)
 Directed by Robert Zemeckis
 Animation director, Richard Williams

RIGHT: Frame enlargements of the completed version of Scene 75 of "Somethin's Cookin."
Who Framed Roger Rabbit (1988)
 Directed by Robert Zemeckis
 Animation director, Richard Williams

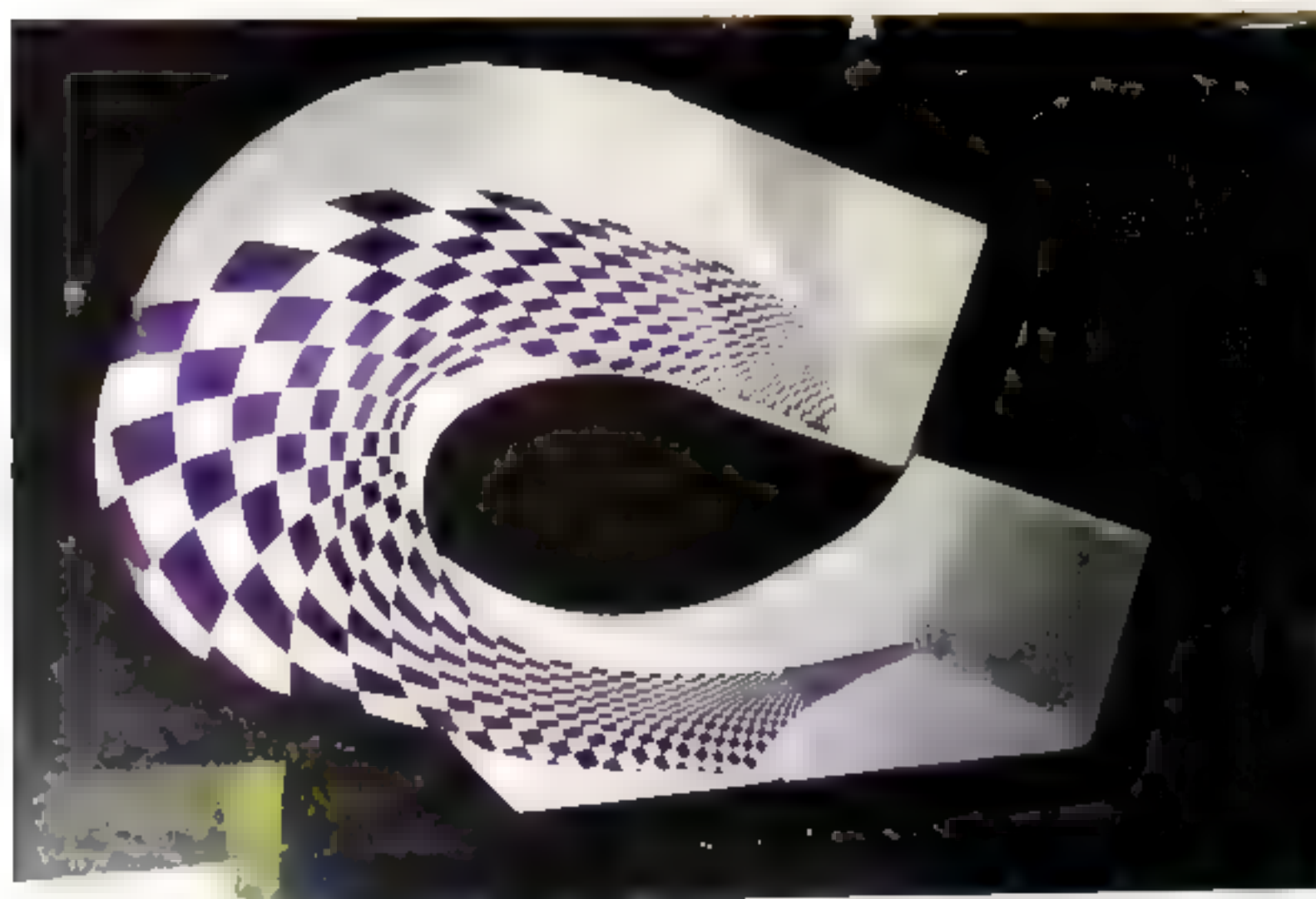
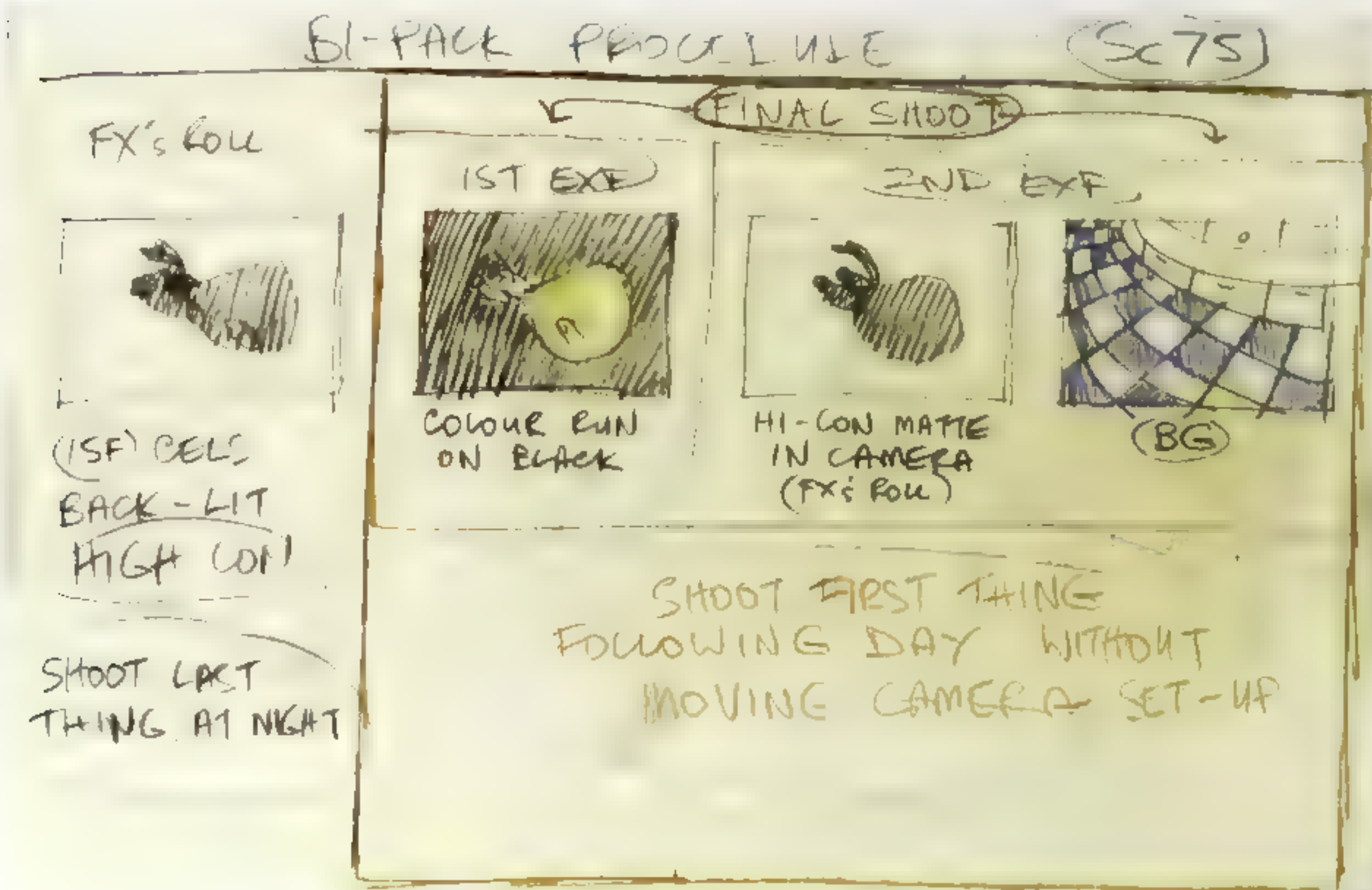


TOP To ensure precise continuity and accurate registration between the different camera "passes" required for this one, highly complex "in camera" shot, the planning in this second diagram extends to suggesting that the second and third exposures be photographed the morning after the first, high-contrast effects "roll" has been captured on the rostrum.

Illustration by Bill Frake
 Animation, Pixar
 Animation, Pixar

BOTTOM To create the illusion of the camera following Roger Rabbit through three-dimensional space as he flies around the kitchen, the completed (flat) background painting for this same scene had to be shaped like a giant horseshoe in order to accommodate the extreme shifts in perspective.

Illustration by Bill Frake
 Animation, Pixar
 Animation, Pixar



ONE-OFF MODELS

In-house software teams continue to work tirelessly with artists to narrow the gap between the kind of spontaneous invention that traditional drawing techniques allow and the more ponderous constraints of real-time digital display. As Rob Cardone explained:

Bill Frake did a beautiful, dynamic job storyboarding the "Scrat" sequence [the opening sequence of the first *Ice Age* movie]. He used a lot of 2D drawing tricks that can really "sell" dramatic "up shots" and forced perspectives and dynamic camera angles. But when you're working with an actual CG set, you can't curve a ground plane or push a dynamic angle without having to build a one-off, shot-specific model. So you wind up in a situation where the 'boards at times could look more dynamic than the actual shot does.

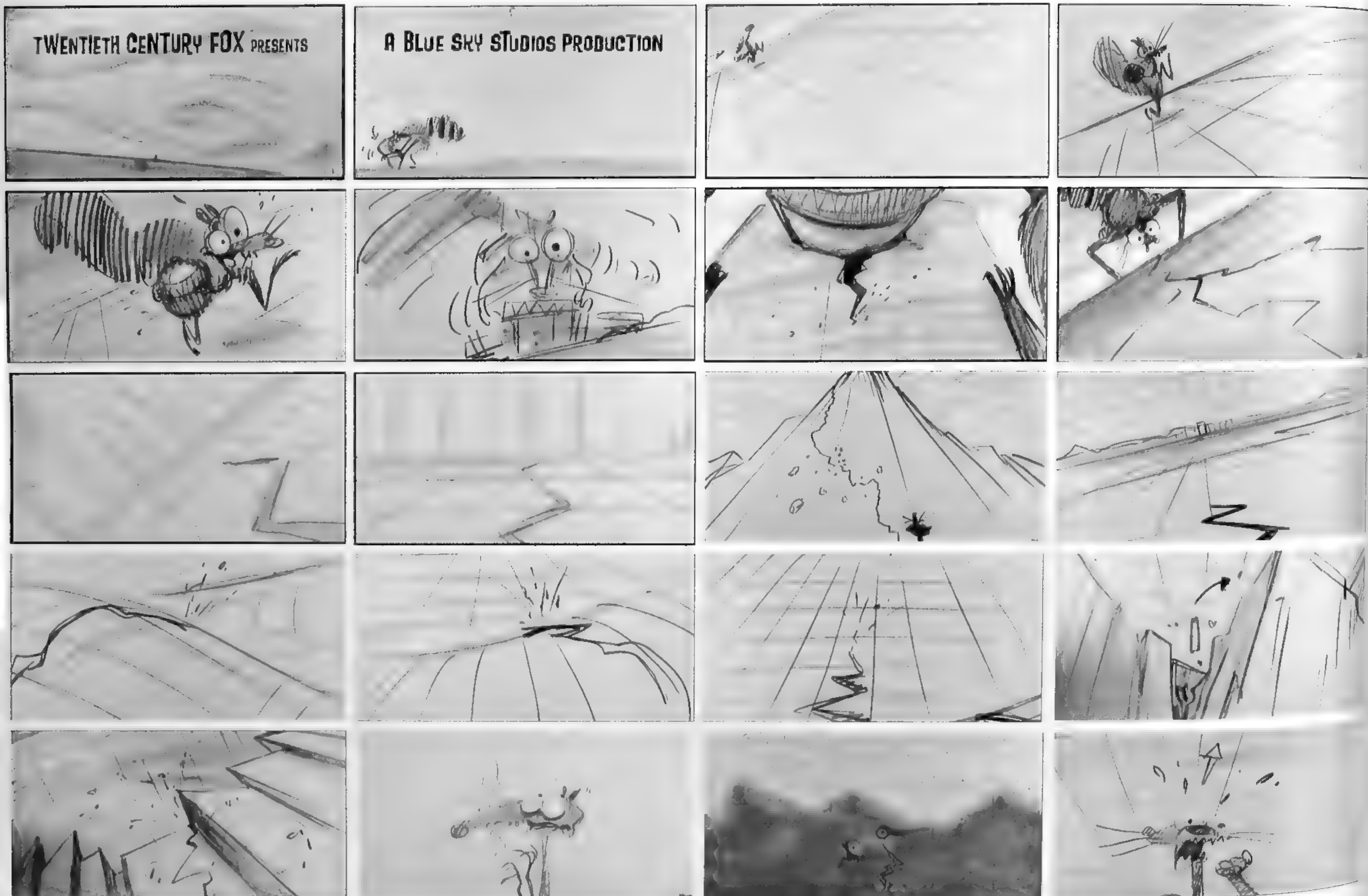
Another problem is that you don't see barrel distortion⁹ within the CG program itself. You will see it later when it's rendered, but you don't see it when you're looking at the scene on someone's desk. So that was definitely a challenge, to try and maintain what Bill had in his "pushed" drawings in the 3D environment without causing too much shot-specific modeling.

We pretty much have an open ticket to be able to do that whenever we want to now. They do have to make adjustments, but it's not nearly what they had to do for *Ice Age I*. As a result of that challenge, the in-house software guys have been able to make it easier for us in following pictures.

Story artist Bill Frake drew on a diverse range of design influences, from German expressionist filmmaking to American magazine advertising, in his masterful storyboards for the opening "Scrat" sequence in *Ice Age*. In the words of Roy Naisbitt, "A good storyboard is a good layout."

Ice Age (2002)

Directed by Chris Wedge and Carlos Saldanha



As Bill Frake recalls, "Back when I was working with Eric Larson at Disney, he talked about how Milt Kahl would put everything in the expressions, like the key poses on Madame Mim, for example, in *The Sword in the Stone*. Richard Williams would say the same thing: when the character's acting, the eyes and the hands are the most expressive parts. So, in order to translate that same idea into layout

you have to ask, 'Where's the focus in the frame...?' It's all the same thing: character design, layout, animation. It's a question of how much time your eye has to register something and where you're going to look on screen. In that sense it should all work together as one piece."

Ice Age (2002)

Directed by Chris Wedge and Carlos Saldanha



TOP, RIGHT: Phil Nibbelink and Mike Peraza study the wireframe displays of the computer modeled cog wheels inside the digital Big Ben constructed for *The Great Mouse Detective* (1986).
The Great Mouse Detective (1986)
Directed by Ron Clements and John Musker

BOTTOM: General Motors provided the wireframe computer models for many of the vehicles which appear in the street scenes in *Oliver & Company* (1988).
Oliver & Company (1988)
Directed by George Scribner

OPPOSITE: Five years before the famous ballroom sequence in *Beauty and the Beast* (1991), traditional hand-animated characters had been integrated, not only with a digitally modeled environment but with the complicated individual moving components of the giant clock mechanism of *Big Ben*.
The Great Mouse Detective (1986)
Directed by Ron Clements and John Musker

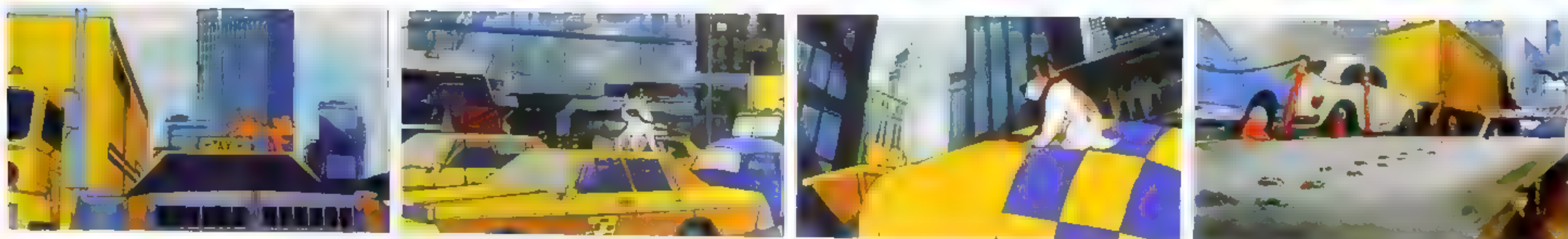
TRIPPING OVER THE COMPUTER: NONORGANIC PROPS AND DYNAMIC MOVES

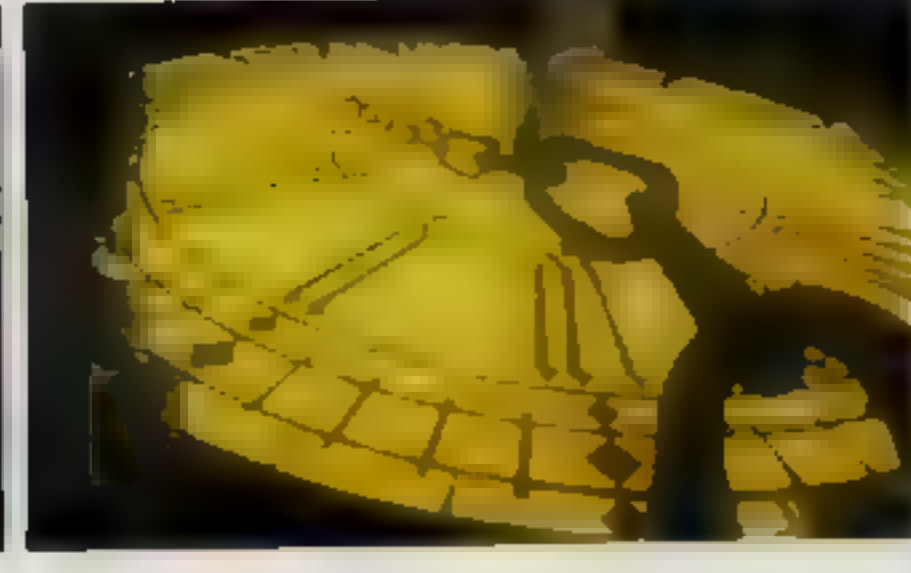
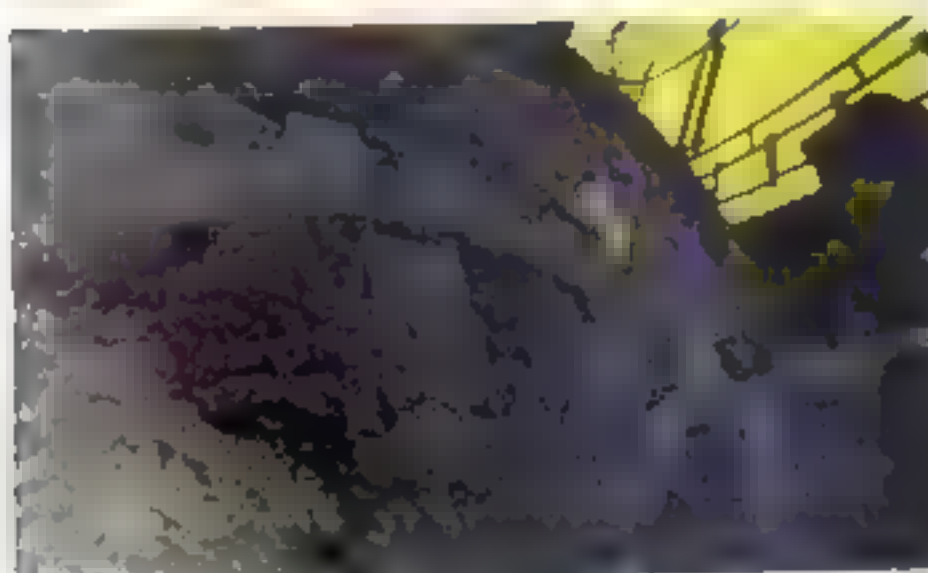
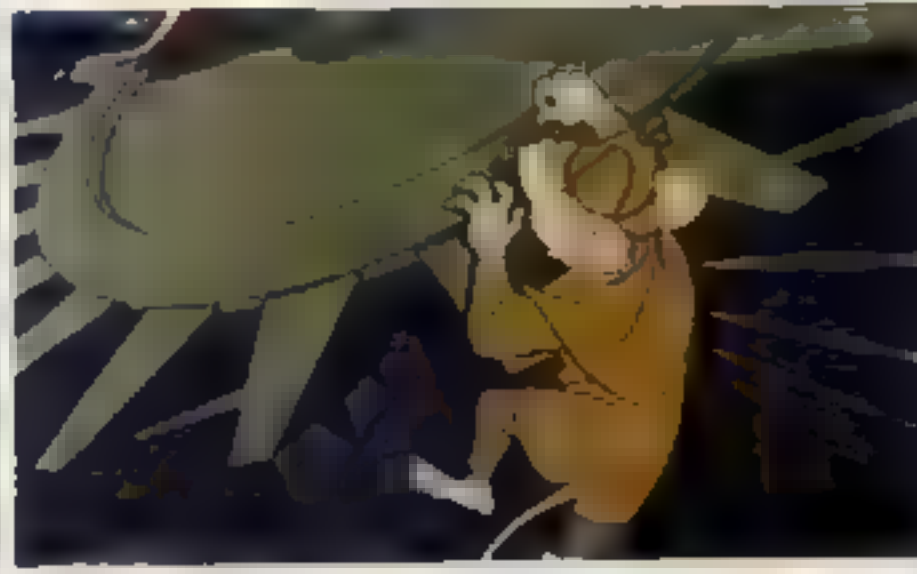
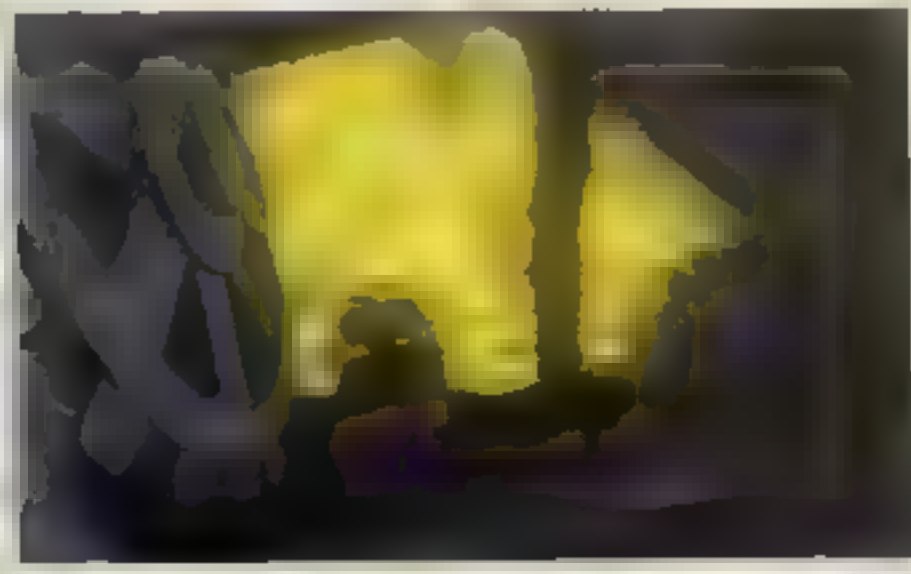
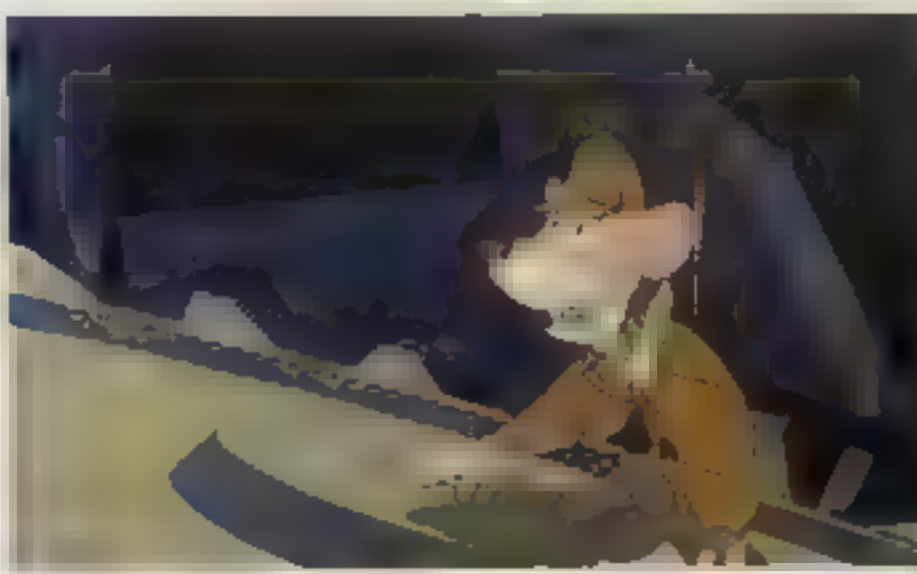
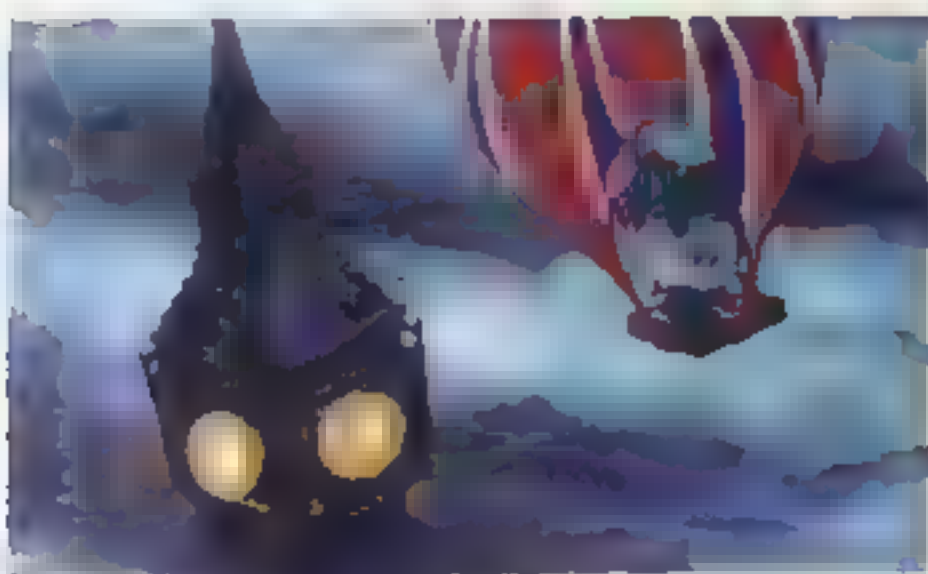
After Disney artists cut their teeth on the simple geometry of the *TRON* environments and the New York streets in *Oliver & Company*, it became clear to them that they could use the new computer modeling tools to build and move the kind of props and scenic elements that, due to the problems of maintaining volume and perspective in hand-drawn nonorganic objects, previously had to be built in miniature and then photographed. As Dan St. Pierre put it:

CG is a tool just like anything else. It started out as a drawing aid; you could build a Gothic vaulted ceiling and print it out and then it would help you understand that very difficult perspective. Or looking down the gunwale of a boat where it's tapering to the bow. To draw a bow like that in perspective is really, really difficult to do and be convincing, so that was the first thing. And the second thing was to be able to move the camera in more dynamic ways.

By the mid-1980s more and more people were beginning to sense the possibilities inherent in using a computer, not only to create and furnish virtual sets but also to create the kind of camera movements which would lead the audience into and through these environments in engaging ways. At that transitional time, however, the only practical way to integrate character cels with digitally modeled geometry was to print the outline of the digital geometry onto cels as well, as John Musker remembers:

On *The Great Mouse Detective*, Phil Nibbelink and Mike Peraza were the big proponents of trying to use the computers so that you could really liberate the camera and move on the z axis as well as the x and y. There were a few instances where we may have tripped over the computer, but generally I would say it was a tremendous asset. Although it was primitive, I can't imagine doing it some other way. Because all those clock gears in the "Big Ben" sequence were a potential Ink & Paint nightmare, they treated them almost as a color card so the big "painted" areas on the cogs were actually the background color. It was a crazy way to do it, but they saved some painting time, and I felt like it really gave us something.





TOP: The full cinematic ambition of the “Fire Jump” action sequence in *Spirit: Stallion of the Cimarron* is visible in the dramatic lighting and dynamic composition of this preproduction drawing by Luc Desmarchelier.

Spirit: Stallion of the Cimarron (2002)
Directed by Kelly Asbury & Lorna Cook

“TRADIGITAL”

As the CG toolkit expanded, animation layout gradually “escaped the page” in much the same way as Ko-Ko the Clown did in the Fleischer Brothers’ *Out of the Inkwell* movies in the 1930s. Alongside Disney in the 1990s, other studios were also developing and expanding the available techniques for blending 3D and 2D elements. In *The Iron Giant*, for instance, the animators at Warner Bros. moved a 3-dimensional character seamlessly through a world made up almost entirely of 2D scenic elements. On feature movies from *Prince of Egypt* to *Spirit*, the artists and technicians at DreamWorks Animation were exploring the possibilities of 2-dimensional animation inhabiting an increasingly 3-dimensional “stage.” As Damon O’Beirne recalls:

We were always drawing with staging in mind and trying to create that sense of depth and atmosphere out of flat elements. I had spent quite a bit of time experimenting with some of the early software applications and then, when I came over to DreamWorks Animation, they were developing a software application that let us build all these multiplane moves in the computer. It was great because traditionally you would lay out all these elements and go, “I kind of think that’s going to work . . .” and you’d send it nervously down to Camera hoping it would be OK.

Matt Aspbury, a former Layout colleague of O’Beirne’s at DreamWorks Animation now working at Pixar, recalls the struggle just to find an appropriate vocabulary for what the artists and technicians were doing:

Spirit was the first movie where we really used a lot of 3D. There was a cavalry chase sequence where we set up these projection cameras,

BOTTOM: In the predigital era exotic and inaccessible landscapes were often painted onto sheets of glass through which the camera then filmed, with the actors performing on a more modest sound stage or location beyond this “matte” image. Within the computer, flat scenic artwork can easily be painted and then “projected” onto digital “flats” to create a comparable (and often far more convincing) illusion of depth and scale.

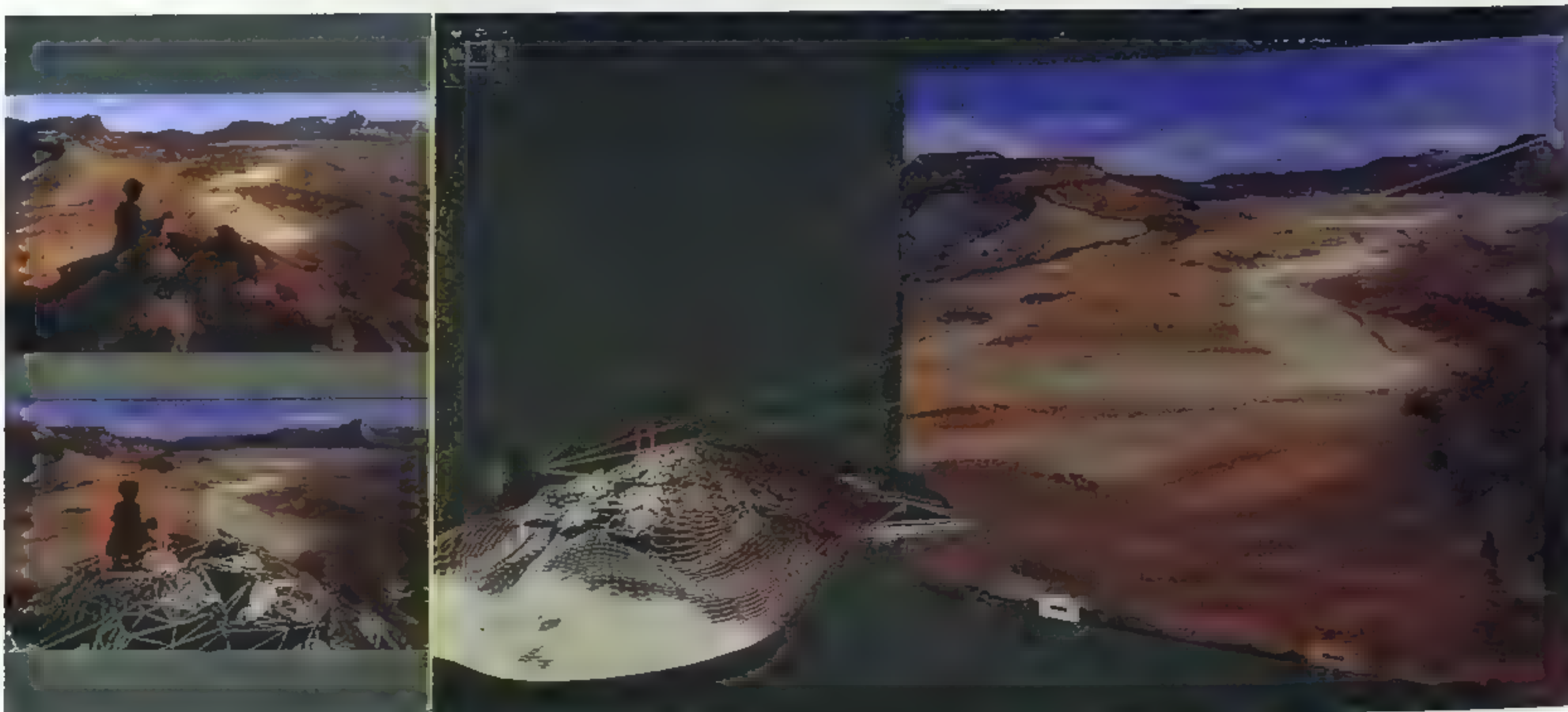
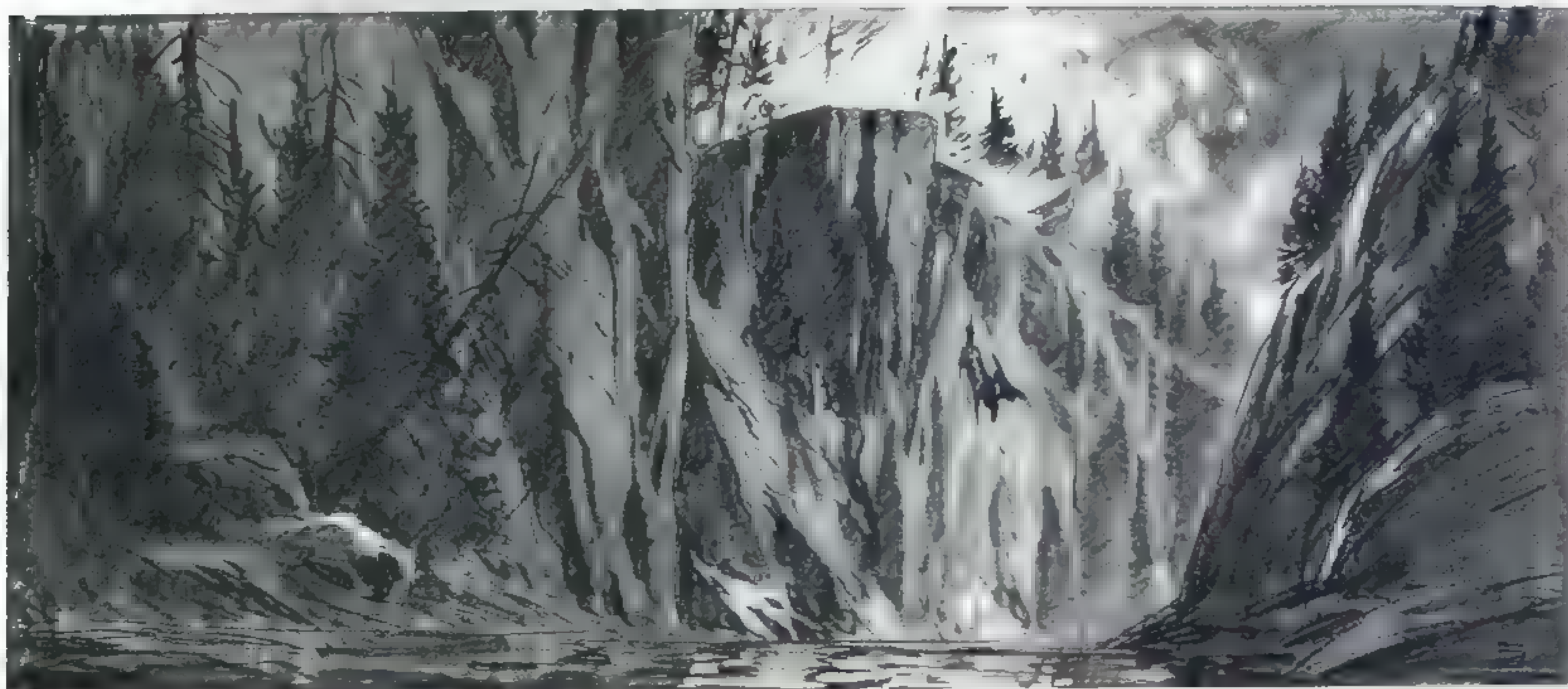
The Prince of Egypt (1998)

Directed by Brenda Chapman, Steve Hickner & Simon Wells

OPPOSITE: Through a masterly use of stark tonal values and dynamic perspective, this hand-drawn image produces a striking sense of movement, deliberately prefiguring the tracking, by the virtual camera, of an eagle in flight.

Spirit: Stallion of the Cimarron (2002)

Directed by Kelly Asbury & Lorna Cook

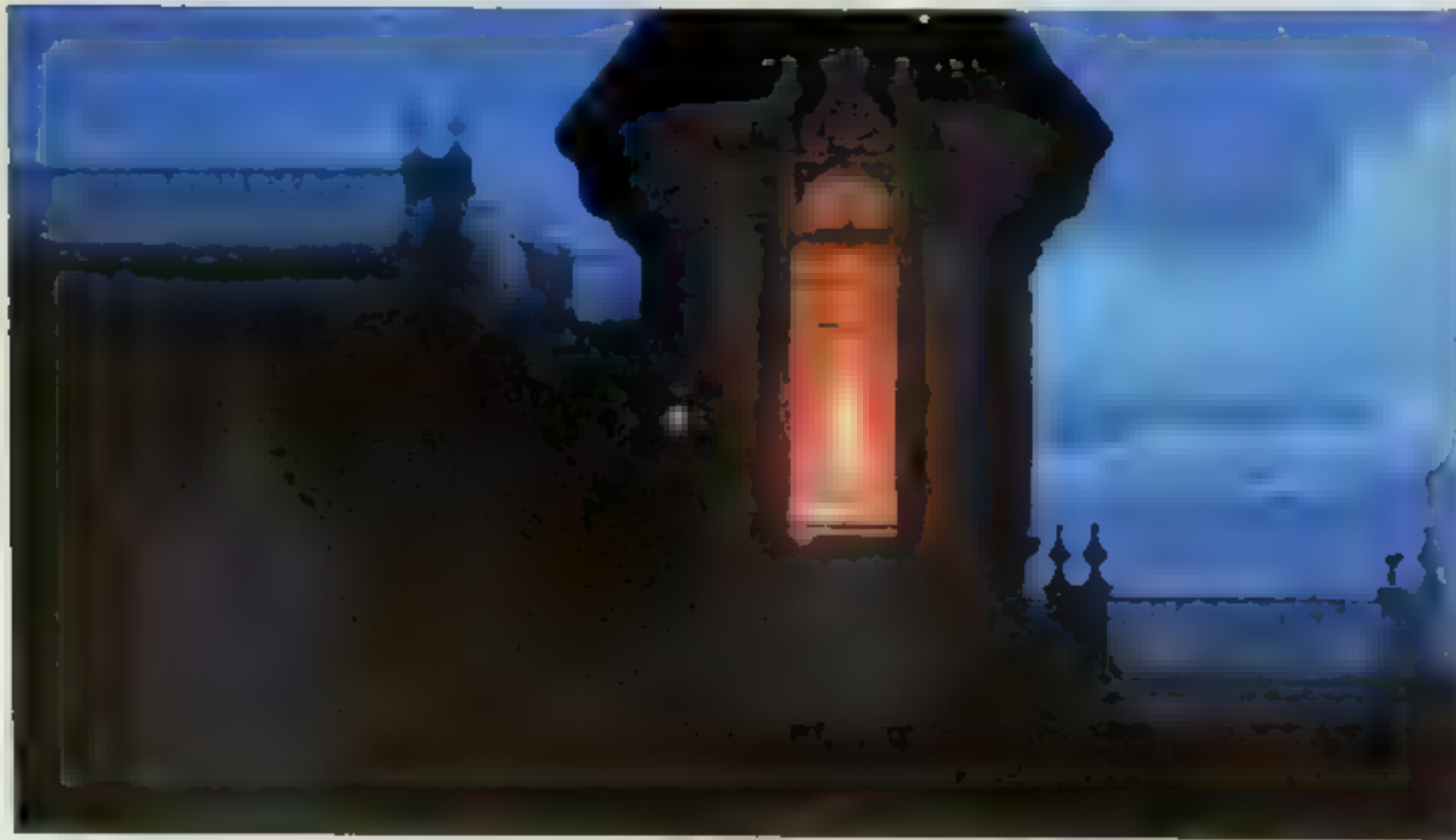


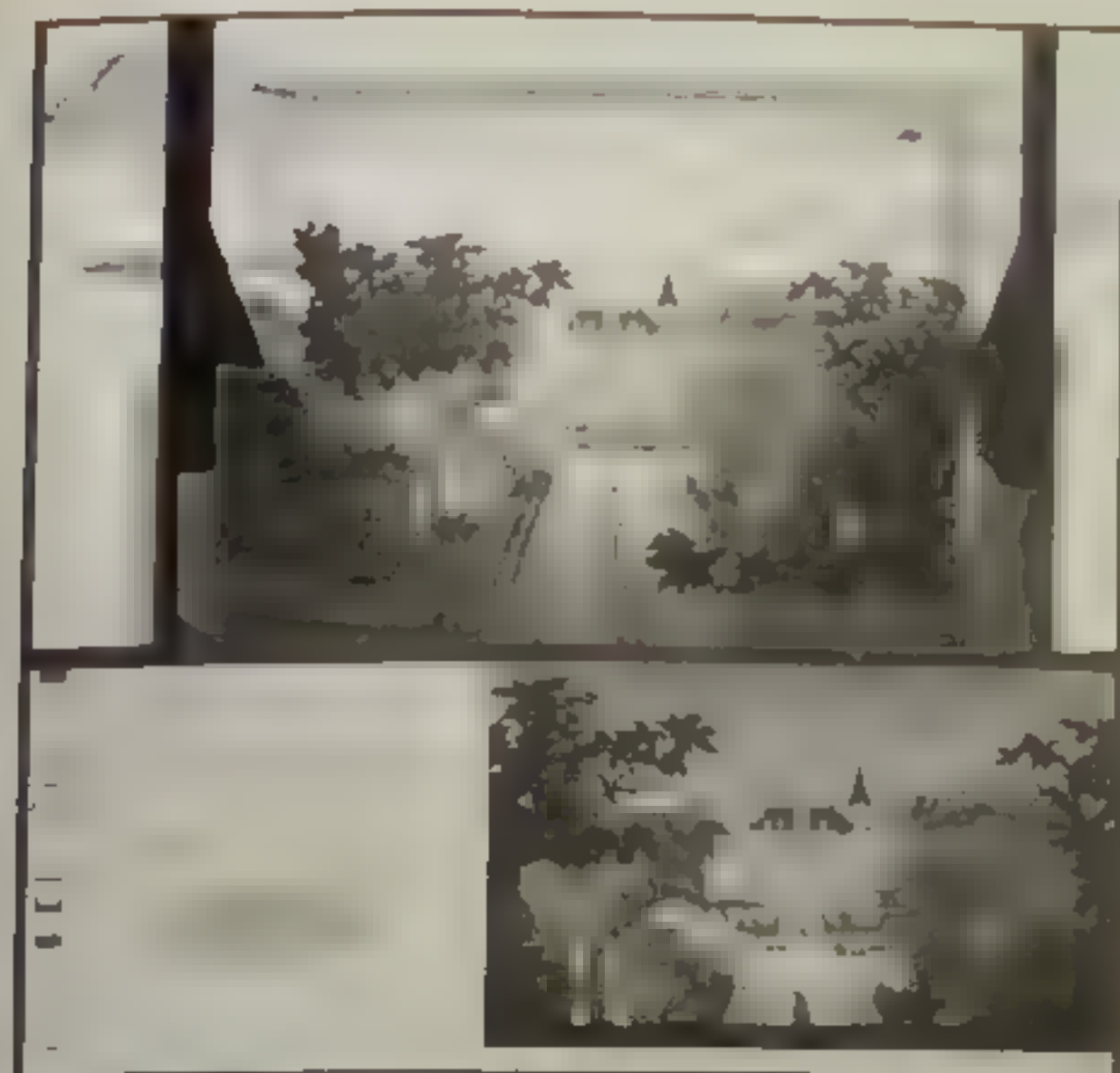
building rough geometry and setting up cameras on them, and doing rough animation and plotting it all out. So it was basically 3D backgrounds. At the time Jeffrey Katzenberg called it “tradigital”—it was his term for the 2D/3D hybrid.

“BACK INTO THE DRAWN UNIVERSE”

When the Fleischer “Stereoptical” turntable and the original Disney multiplane stand were designed and built in the 1930s, no matter the effort and artistry applied to the problem, 2-dimensional and 3-dimensional components could never share the







screen without some kind of screen perspective. But by the turn of the century, when digital graphics had reached such a level of maturity that 3-dimensional digital objects could coexist comfortably now with traditional cartoon elements but also with live-action, the great was the level of control available over the surface rendering and lighting, so that such integrations could, at last, be achieved.

As traditional animation has only begun to gain some of the momentum it built up in the initial rush toward a fully digital production pipeline, it's interesting to note how designers, and animators are beginning, at last, to establish a balance between what's possible and what's actually appropriate in terms of the chosen aesthetic of a particular production. A virtual animation camera can not only advance in a straight line through digital space, it can also rotate within a 3-dimensional set and explore it. In some cases, however, traditional animation seems to require that the filmmakers respect the integrity of the medium, returning to the more theatrical artifice of flat elements arranged in parallel planes. John Musker described how he and his team had been drawn to such an approach on *The Princess and the Frog*:

On this movie, because it takes place in the Bayou we have a mixture of organic elements with the architectural and wrought-iron elements of the New Orleans French Quarter, and I think building those interiors and architectural elements with cel has really been a boon. But they do have to go back and translate those things and liberate them from the rigidity of "real" perspective. If it's too literal, or if it's too dry and not organic enough, if it's too separate from the other hand-drawn elements, it can stiffen up so all of our 3-D elements have to go through a process where they're softened up.

Represented on screen by a white line outside the display area, the camera moves through the scene, and the elements of the scene are rendered in a way that makes them appear to be part of the scene. The camera moves forward and backward, and the elements of the scene are rendered in a way that makes them appear to be part of the scene.

And they really do have a sense of depth, and they're not just flat elements. They're really 3-D elements, and they're rendered in a way that makes them appear to be part of the scene.

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BIG BEAUTIFUL SETS

PREVIZ AND THE GROWING WORLD OF DIGITAL COVERAGE

"The interesting thing is, by the time you get into CG you've really come full circle, back to just the fundamentals of filmmaking—period! Regardless of whether it's animation or live-action. It's just about filmmaking."

LEE UNKRICH, EDITOR AND DIRECTOR, PIXAR

Throughout the history of cinema, there have been directors, from Georges Méliès to Terry Gilliam, for whom animation tools and processes have simply formed part of the wider palette of moviemaking possibilities. As digital modeling and character animation techniques have become ever more sophisticated, it has even been possible for digital mannequins to perform the kind of life-threatening stunt work that would previously have added to the worries of a crew and the insurance costs of a production.

One particular preproduction process known as *previz* (previsualization) has come to the fore as the common technical and artistic ground between live-action visual effects and "pure" animation has grown ever broader. Low-polygon versions of characters, individual sets, and entire environments can now be built quickly and inexpensively, allowing the director, layout artists, and animators to visualize more clearly how the finished movie will look. Time can then be taken to modify and improve the designs before work begins on constructing the final, high-resolution geometry.

Techniques such as *mo-cap* (motion capture), in which performers' movements are tracked and recorded in a live studio environment that has been mapped in advance to the *x*, *y*, and *z* coordinates of the computer, also replace the labor-intensive and increasingly rare craft-actor process of rotoscoping (projecting a high-quality live performance a frame at a time onto a digital

This has, of course, meant that filmmakers and studios who once sat apart from the animation community *per se* have found themselves face to face with the possibilities and procedures of the animation layout process. James Williams recalls how Sony Pictures Animation gradually began to emerge alongside Sony Imageworks:

In visual effects, the only type of Layout Department that you have is a department that prepares animation. They take the live-action plates, pull them into the digital environment, pull them into the shot, bring in characters, and put the scene together. Because the composition and the cameras are already preplanned, Layout essentially didn't exist here at Sony, so the concept of somebody having to go through that process was not something that the company had ever been used to before.

On *Polar Express*, the Layout Department worked under the artistic supervision of the director of photography, Robert Presley, and since it was the first of the motion capture movies, Robert Zemeckis was directing actors on the set with an idea of where he wanted to shoot the scene from, but with no specific camera placement in mind.

The motion of the characters they recorded on the set would then be brought into the computer and a basic camera position would be determined in

previz. But that camera was not the final camera—it was simply put there to determine whether they had the coverage that they needed. So the scene was then brought into the Layout Department at Sony, and that was the point at which we added the environments and started to add nuance to the camera.

The Layout Department put the set into the sequence, determined how big it should be, and populated it. All those infinite vistas of trees that you see in the movie were actually done by the Layout Department because, of course, the sets themselves were camera-dependent. I was constantly explaining to my colleagues at Sony that "This isn't what layout usually is" because, of course, we wouldn't normally start with an animated character and then try and record it. The blocking of the character is part of the basic job that the layout artist would normally do.

The layout crew at Disneytoons has also demonstrated how *previz* can support the work of the story crew, as John Bermudes explained:

We're always looking for places to get the director and the board artists to "think cinematography." How can you think dimensionally, think how the camera's going to move? That helps us tremendously and I think it helps the director as well. The storyboard crew is often cranking through sequences just as we are, and their number one task is really getting the emotional tenor of the story, the rough staging and the emotion of it. So they don't have time to do any rotations or perspective changes or any sophisticated camera moves. But we can give them screen grabs off of a schematic set that they can start "boarding" and start getting excited about the possibilities.

The seamless integration of animated characters and 3-dimensional environments finally became achievable when computer modeling, lighting, and rendering toolkits reached levels of sophistication that allowed animators and directors to explore the camera and editorial "language" of live action.

The Polar Express (2004)

Directed by Robert Zemeckis

Directors of photography Robert Presley, Don Burgess

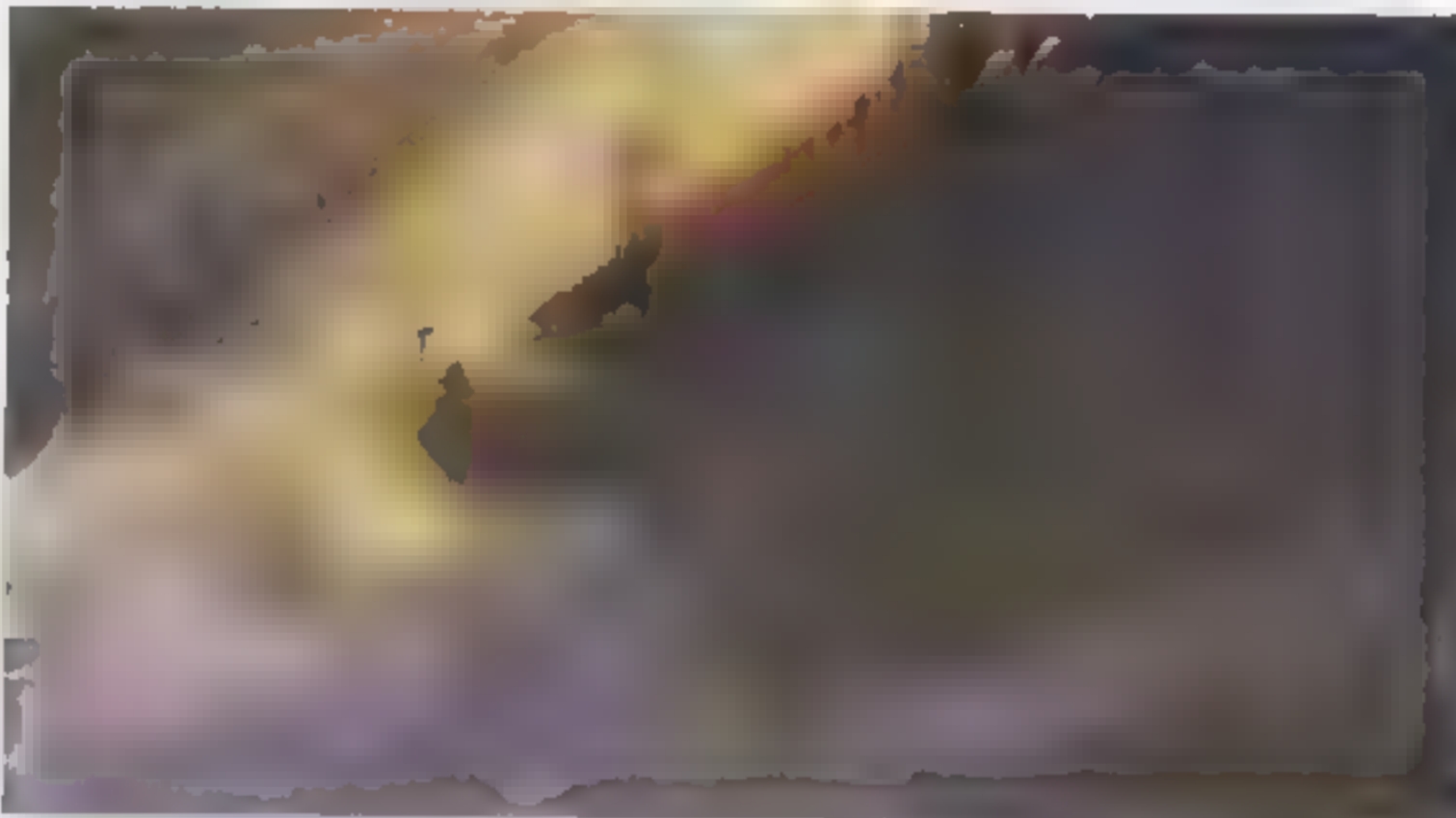
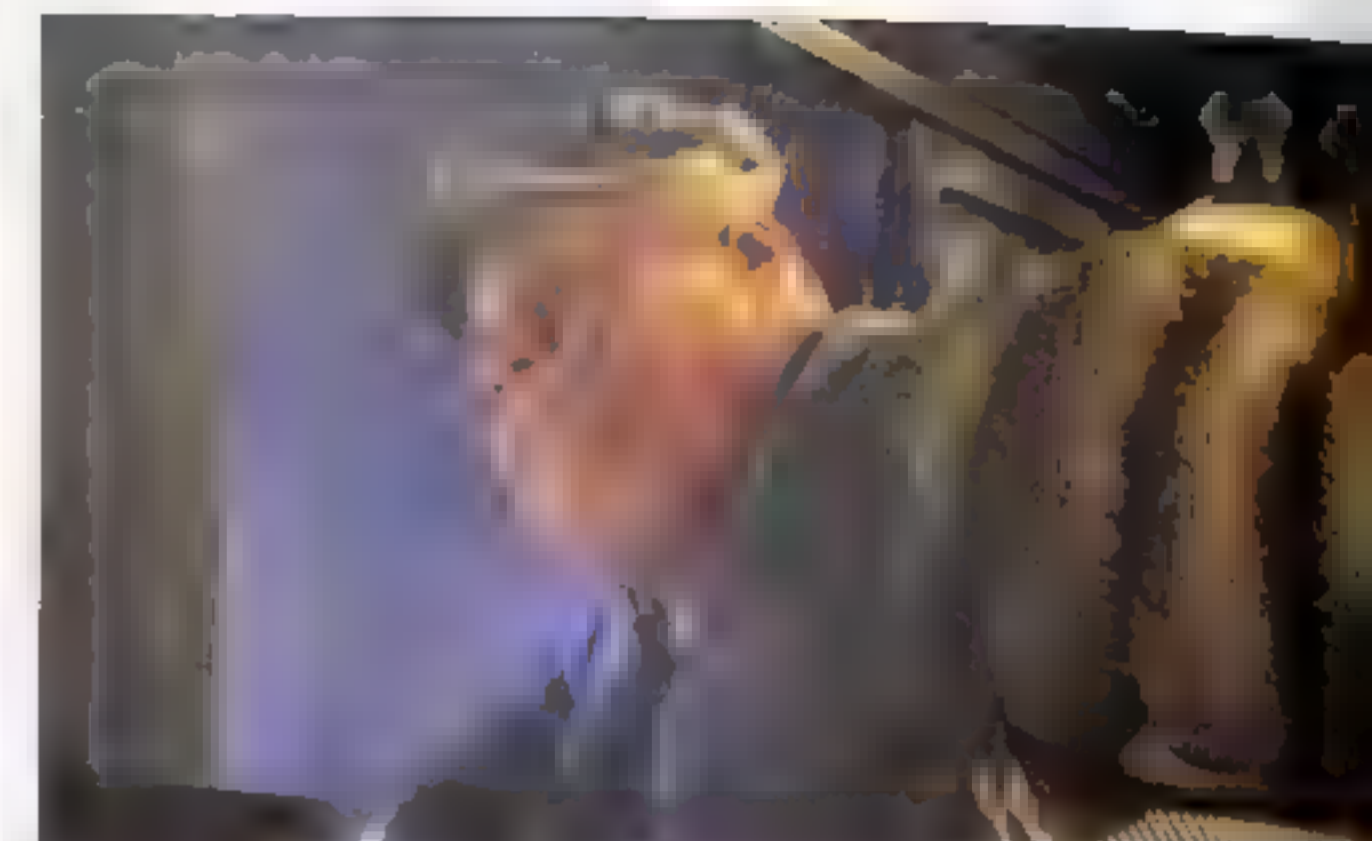
Production design Rick Carter, Doug Chiang

Layout supervisor James C J Williams

Lee Unkrich confirmed how effective the previz process has become over the years at Pixar. With the exception of rough concept sketches, it was more common in traditional animation for the Layout and Background Departments to draw (or paint) only those parts of a set or environment that would be visible to the audience in the final film. Similarly, previz artists can construct simple models of large areas of a landscape or city neighborhood, secure in the knowledge that only selected areas will ever need to be fully rendered. This stage of preproduction therefore acts not only as an inspirational process but also as a means of controlling expenditure in true Ken O'Connor "purse strings" style:

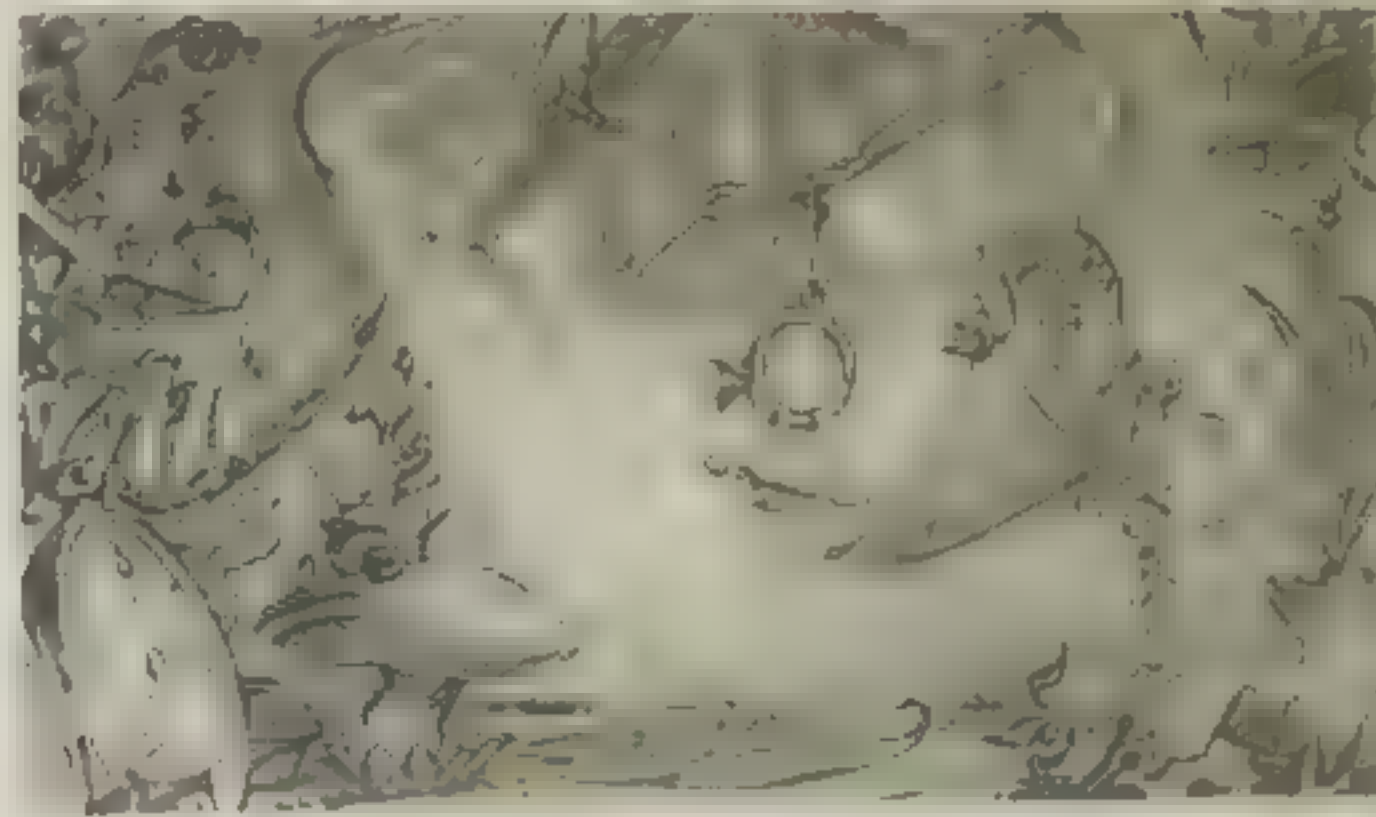
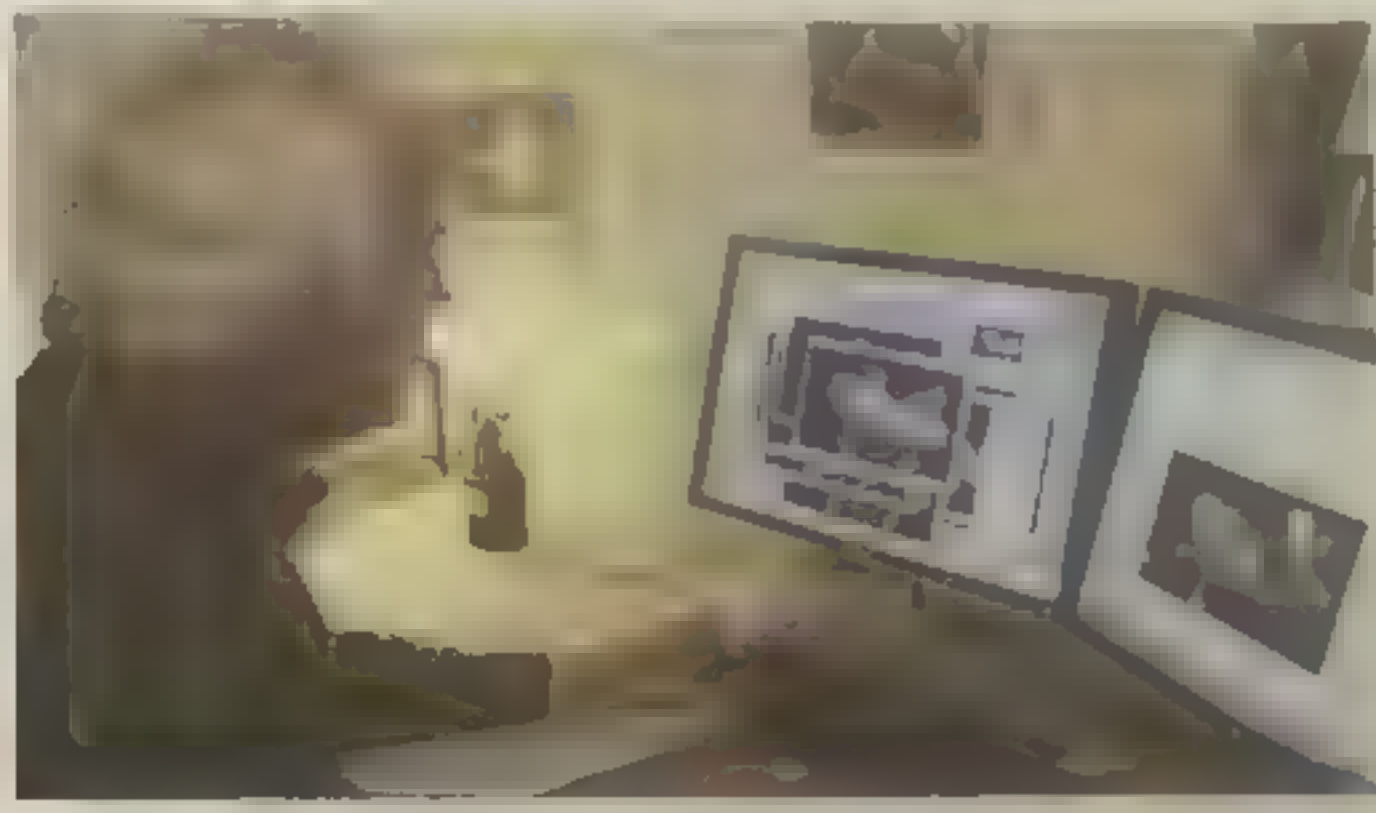
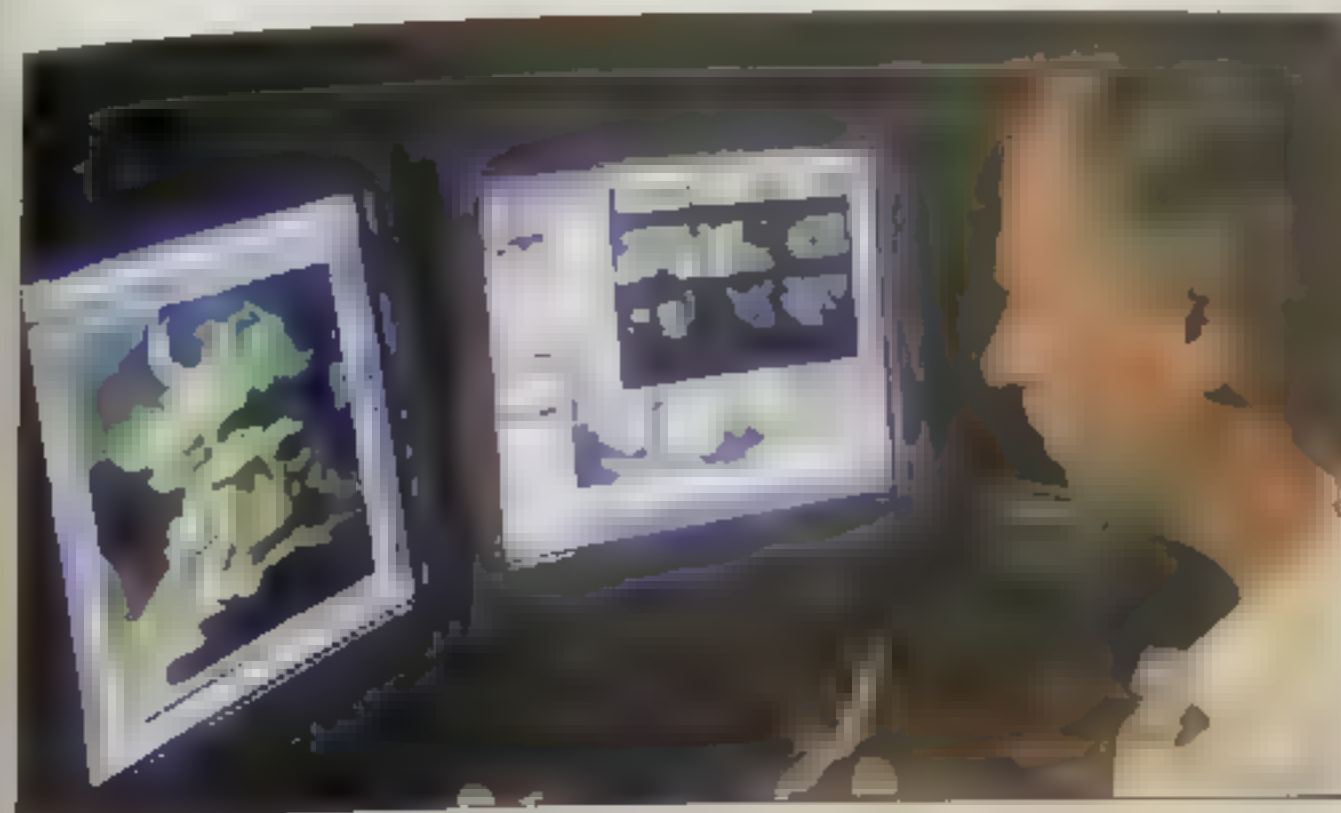
We started very quickly, even back on *A Bug's Life*, moving toward a model of building our sets out in a way that would give us the most flexibility in layout so we'd have this big beautiful set and we could take the camera anywhere we wanted in it. It was a little harder back then, given the speed of computers, to be able to scout in the way that they were able to on *WALL-E*, but we were really doing that back then.

For me the discovery, once we've built a set, is a big part of the process—just being inspired by what I'm seeing and reacting to it. That's just where a lot of the joy of filmmaking comes for me, so I like to have a set that I can look around, and what we've had to do over time is figure out a way, again, to have our cake and eat it too. And we've done that by starting to really previz in a big way, building very cheap versions of the sets so that we can get in there with cameras, try different lenses, and find ways of shooting the scenes so that we can feel very confident that we have what we need. The artists can then go off and build the hi-res, beautiful, detailed sets in a more efficient way.



Art Director Fred Warter (top left) and Story Artist John P. Rowley (top right) work freely with both hand-drawn and digital elements.

As the same location may need to be measured for light and weather conditions at different points in the day, "You have to establish the visual identity of each setting independently of the character's volume that might apply to it." By making a rough sketch, determining a color palette, and establishing key compositions that guide the camera and the audience's eye to the focal point of each scene (usually line, geometry, and chiaroscuro [light and dark]).



LOCATION SCOUTS AND SWEET SPOTS

James Johnson, who joined the Pixar crew in 2005, says that the studio's location scouts are made up of the design team and John Lasseter, who works in these early stages.

"I would have been a scout if I had been a scout," Johnson says. "When we get the location, then we need to do a rough sketch of the location. You just need to look at them with a camera, a lens, and a camera lens, and you need to look at them from a point from low to high to find where the sweet spots are. They're very intuitive and they really understand. With *Woods*, you need to be just barely in a room to get the really perfect view with the camera. You need to be just a little bit further and you don't pass the character, you don't make the right decision about that, so that leads into the nature of kind of staging in front and blocking and making together because you have to do your first pass of blocking the character to be your favorite."

Ewan went on to explain how this "sweet spot" principle holds up when it comes to environmental geometry and beyond the question of camera angles, how important it can be to venture out into the low-resolution version of an environment.

During one of the initial modeling sessions on *A Bug's Life*, one of the modelers was a sculptor, and he was modeling the geometry of Ant Island around the time John Lasseter had a different angle of a scene that he had stopped and said, "That's it! That's the opening of the film! What would it be like to be in there and come up from the mud and see the trees and the mud and the sun, and so with the camera moving to a small angle." Just by looking at a more round of a model to approach for shape and form. Another instance of this sweet spot.

LEFT: This simple two-shot demonstrates what Ewan Johnson describes as the "sweet spot" for these two characters, with the lens positioned "just below [Woody's] sternum" and "just a little bit higher" in relation to Buzz.

Toy Story (1995) Disney/Pixar
Directed by John Lasseter



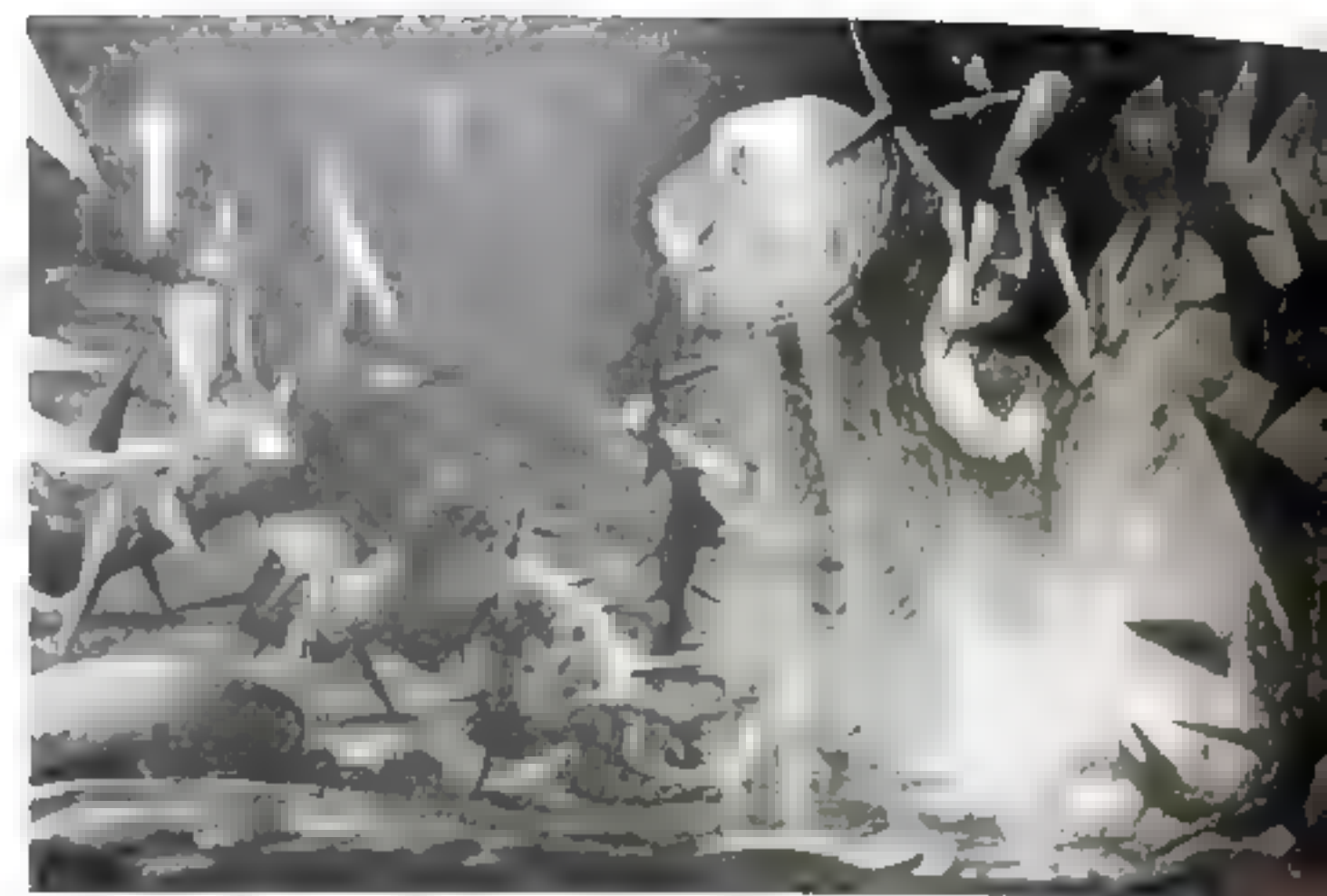
It really made me aware of the concept of "location scouting" and responding to the set as an element of the visual design process, so a lot of what I try to do when I get into sets and get into sequences, is actually, for a moment or two, put the sequence away and just "walk" through the set, just the way I would if I were going in to shoot a live-action scene in a real location: where would I put my cameras?

The story itself still governs the kind of camera placement possibilities that an extensive digital "location" may present to the director, the editor, and the layout team, as Lee Unkrich explains:

As we've developed over the years, we've worked our way toward this notion of shooting "coverage," very much in the way that you would in live-action. It depends on the scene. If I'm doing an action scene, I'll often have the layout artist actually block out the characters going through the motions, and we'll cover it from lots of different angles and try different things just for the needs of that one particular shot, rather than doing everything piecemeal the way we used to.

RIGHT: A sound knowledge of different lenses and lighting effects can help story and development artists to create sketches that indicate clearly what the different dramatic possibilities of a location might be in terms of both mood and cinematography.

Development sketch
A Bug's Life (1998) Disney/Pixar
Directed by John Lasseter & Andrew Stanton



ONLY CINEMATOGRAPHERS IN THEIR OWN MINDS

It has taken some time to arrive at this point, however. When he first joined the studio, Director of Layout Jeremy Lasky was surprised to find that, even at Pixar, there was no real consensus about the role that a Layout Department might be expected to play in the CG production pipeline:

When they were staffing up *A Bug's Life* there weren't any other 3D layout artists around. No one had made any other 3D films, so where do you go? So they were casting this wide net, just trying to find people that they wanted to work with and when I interviewed, the supervisor pitched the department as the cinematography arm of the studio. He said that they were really looking for visual storytellers, and I got very excited. Here was this wonderful thing, they were staffing up for *A Bug's Life*, they had done *Toy Story* seat-of-the-pants with only two main layout people and a bunch of technical directors that they grabbed to help out. But what I didn't realize until I got here (because they hid it!) was that they were only the cinematography arm of the company in their minds! That as far as most of the company was concerned, their job was to set up shots for the animators because the animators weren't technical enough to do it themselves.

Lee Unkrich confirmed Jeremy's account of this early period and the prevailing attitude to Layout, which, looking back, must seem rather primitive and confused:

In the very early days on *Toy Story* the Layout Department didn't get any respect at all. It was considered an entry-level position; there was really no respect for them as artists. It took years here before that developed. And I think part of it was through me coming in early on from a

live-action background. When I thought about how I was going to film a scene, when I was directing or cutting something, it was rooted very much in that live-action sensibility, so that's what I was bringing to the table.

Jeremy Lasky chooses to remain philosophical about the struggle for recognition that the Pixar layout team went through in the early years. He arrived at much the same conclusion that his counterparts in the traditional animation industry had reached long ago:

It took us years and several films before the studio as a whole started to recognize what a crucial step Layout specifically plays. Everyone "gets" Lighting because you can show them something as a before-and-after, and it's this beautiful rendered image. You get it! And most people can't figure out how to do lighting so there's this inherent level of difficulty that's assumed. Much like character animation, when you see Woody or WALL-E moving around, you intuitively know that it's hard to accomplish that. By contrast, when you see a shot framed well, you just take that for granted. "Of course it's framed that way! How else would you do it? If it works, it works!"

So much of our job is trying to stay invisible! You want the viewer to be engaged in the story and to follow the characters, not noticing what you're doing with the camera or where you're cutting or where you're moving. So people don't notice.

The full range of possibilities explored by the development artists eventually led to an agreed design for Ant Island that John Lasseter found emblematic, not only of the location but of the movie itself.



PRODUCTION DESIGN: "A LITTLE BIT BY FEEL AND A LITTLE BIT BY NECESSITY"

Their work, of course, can only stay inside if the layout artists remain in tune from the outset with the design sensibility that governs every aspect of the movie's appearance. In order to do this they need to form a good working partnership with the production designer. But, as Ewan Johnson remembers, it took time even for some of the more fundamental principles of mental art direction to become part of the Layout Department's mindset.

There's a did "layout" at that stage we had no idea what set dressing was. The concept of having a dressed set in CG was one of those things that we were still trying to figure out.

I asked Ewan if, as a frame of reference for set dressing, they began to look to live action, to theater, or to traditional animation. How were these emerging problems solved by the layout team?

It was a little bit by feel and a little bit by necessity. It's one of the great things about working with everybody at Pixar, with pretty much everybody in this industry, everybody's always saying, "Well, what are the images? And what are the stories we can tell through these images?"

Layout has to construct the set and put the characters in it so they can stage it. So Model builds these pieces but then Layout puts them together. And then you begin to realize that the way you construct the set is a visual design element, and the organization of the plants and the objects within the room are telling the story as much as the actual objects, and when they were on the stage when we were starting out, we eventually realized that we needed to start to communicate a picture to spectators in the same way.

OPPOSITE: In the course of this opening sequence from *One Hundred and One Dalmatians*, the layout artists use a daring visual “sleight of hand” to remove both a central character and a large prop from certain scenes: in some shots a double bass rests on a chaise lounge in front of the attic staircase while, in others, the same position is occupied by Roger and his piano.

TOP LEFT: Original ink line BG layout drawing: attic staircase in Roger’s bachelor apartment

TOP RIGHT: Original ink line BG layout drawing: Roger’s piano

And initially we did hire a couple of live-action set dressers to do the actual set dressing work.

GET-ABLE IMAGES: DOING YOUR JOB FROM A STORYTELLING POINT OF VIEW

The primary function of the designed environment in feature animation, as in theater and live-action movie design, is to serve the story. By making imaginative use of everything from props and lighting to the height and angle at which they imagine the camera may be placed relative to the main characters, the best layout artists often overlap with Production Design in their work. As Brad Bird explains:

With somebody like Ken O’Connor, layout is not just some cinematic grammar for certain sequences, it’s also set design and it blurs the distinction between the two.

Neither action nor dialogue can easily be followed unless, from the very first frame of each shot, the audience has a clear sense of where they are and why. As Pixar production designer Ralph Eggleston points out:

You want the audience to focus on the characters and follow that through. Those images have to be “get-able” immediately so we work with story a lot in that regard. The sooner the director has information on what sets might look like and iconic shots in the film, the better. Animation in particular has very little time in which to communicate ideas so you’d better have images that sear into the mind as quickly as possible. Let the audience know where you are, what the scene is about. What the emotion is.

As the story is being developed on an animated feature, and while preliminary storyboarding is

CENTER: Frame assembly showing key character positions for Pongo as he runs past “Roger’s corner,” with Roger himself momentarily removed from the composition

BOTTOM: Original ink line BG layout drawing: pan across Roger’s bachelor apartment. Layout by Don Griffith
One Hundred and One Dalmatians (1961) Disney

Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman

in progress, the Design and Layout teams have to start exploring and making suggestions, too:

Having worked in animation layout, too, I think art directing and production design that works “from the outside in” is wrongheaded. Art directing “inside out” means starting with the character and working your way out. Art directing “outside in” means thinking “It’s going to look cool!” or “We want the audience to think it’s busy so we’re going to put a bunch of busy shapes in there.” I say, “No! No! What is the character *thinking*? Why is the character thinking it that way? Where’s the character coming from?” *That’s* what the audience responds to.

You do your job from a storytelling point of view. That’s the most important thing. It sounds so simple—and it is! It’s ridiculously simple. If you really understand that the director has the final call, no matter what, you say, “Here’s what we think the story’s calling for, here’s what we think you could do, here are some other options. What do you want? OK, great. Next!!” It’s just problem solving, every day.

Likewise, in Eggleston’s view, the working dialogue between Layout, Lighting, and Art Direction has to remain open and active throughout the making of the movie:

From a Production Design point of view, I can’t let go of Layout and Lighting. I won’t. I’m not going to just “design some stuff” and then let it go through Production. I follow it all the way through.

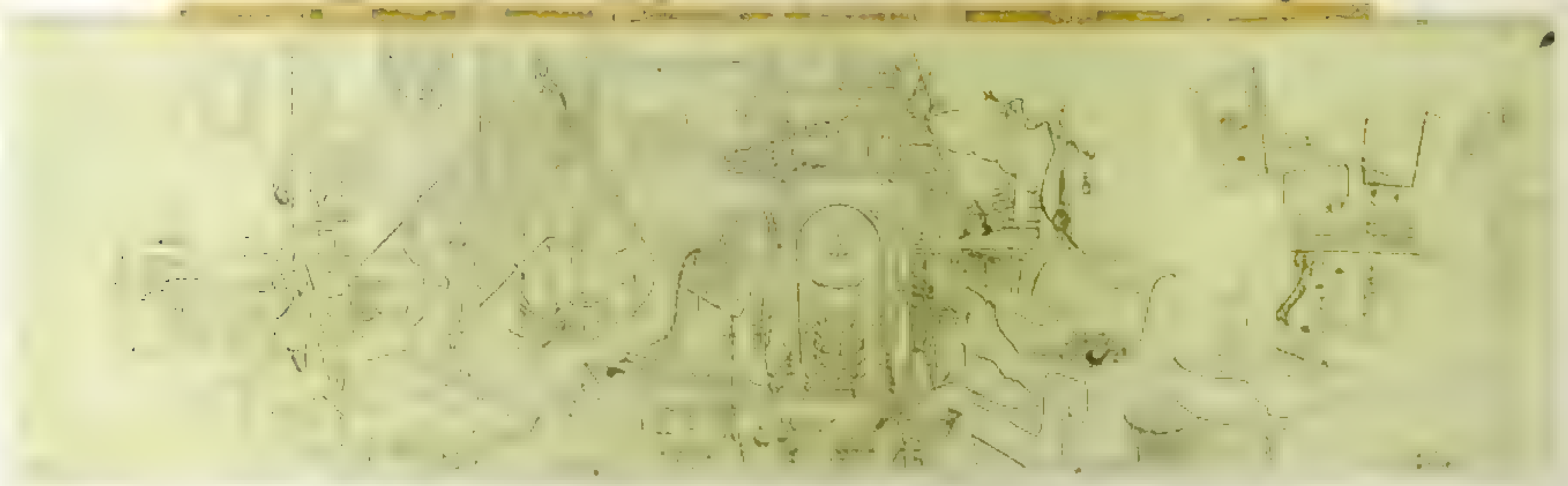
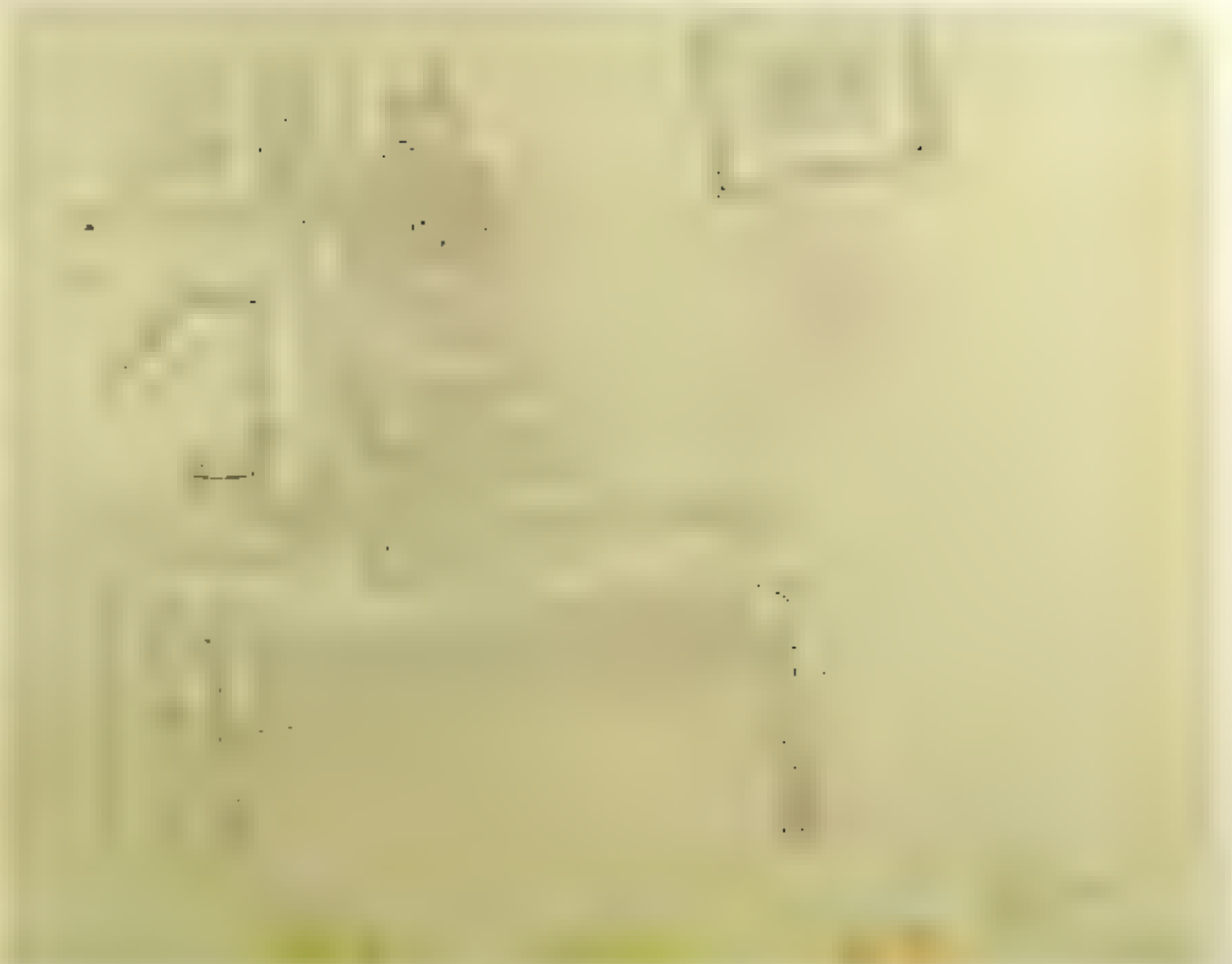
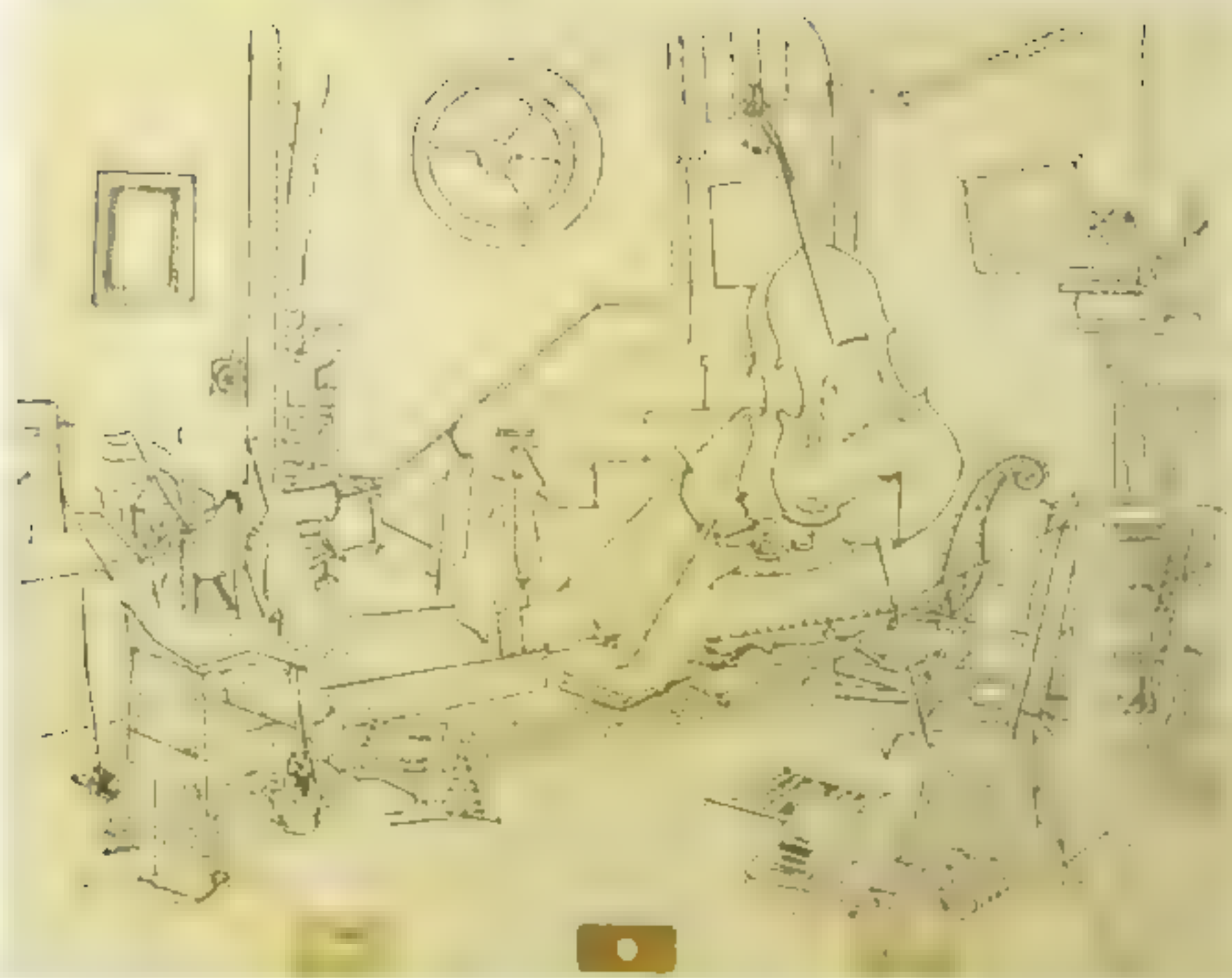
DOMESTIC INTERIORS: STAGING AND “GEOGRAPHY” FOR STORY IN FEATURE

“How you stage the action is as much the designer’s concern as the director’s. Where are the characters’ entrances and exits? Where are they going to stand or sit? How close should the sofa be to the fireplace? You can’t lay out a set or pick a location if you don’t have that understanding.”

—Henry Bumstead, art director, Hitchcock’s *Vertigo*

In Disney’s *One Hundred and One Dalmatians* (1961) the central story is set in motion by the arrival of the scene-stealing Cruella De Vil. But the threat posed by a good cinema villain is only meaningful if we first of all care about the world she or he vows to destroy. So in the film’s opening sequence the layout designers introduce us to an appealingly ramshackle world where Roger, an aspiring but absent-minded songwriter, shares a cramped, untidy bachelor flat with his pet dog, Pongo. The props and set dressing play an important role in filling out Roger’s character beyond what the audience can hope to discover from the performance and the dialogue alone, as Brad Bird makes clear:

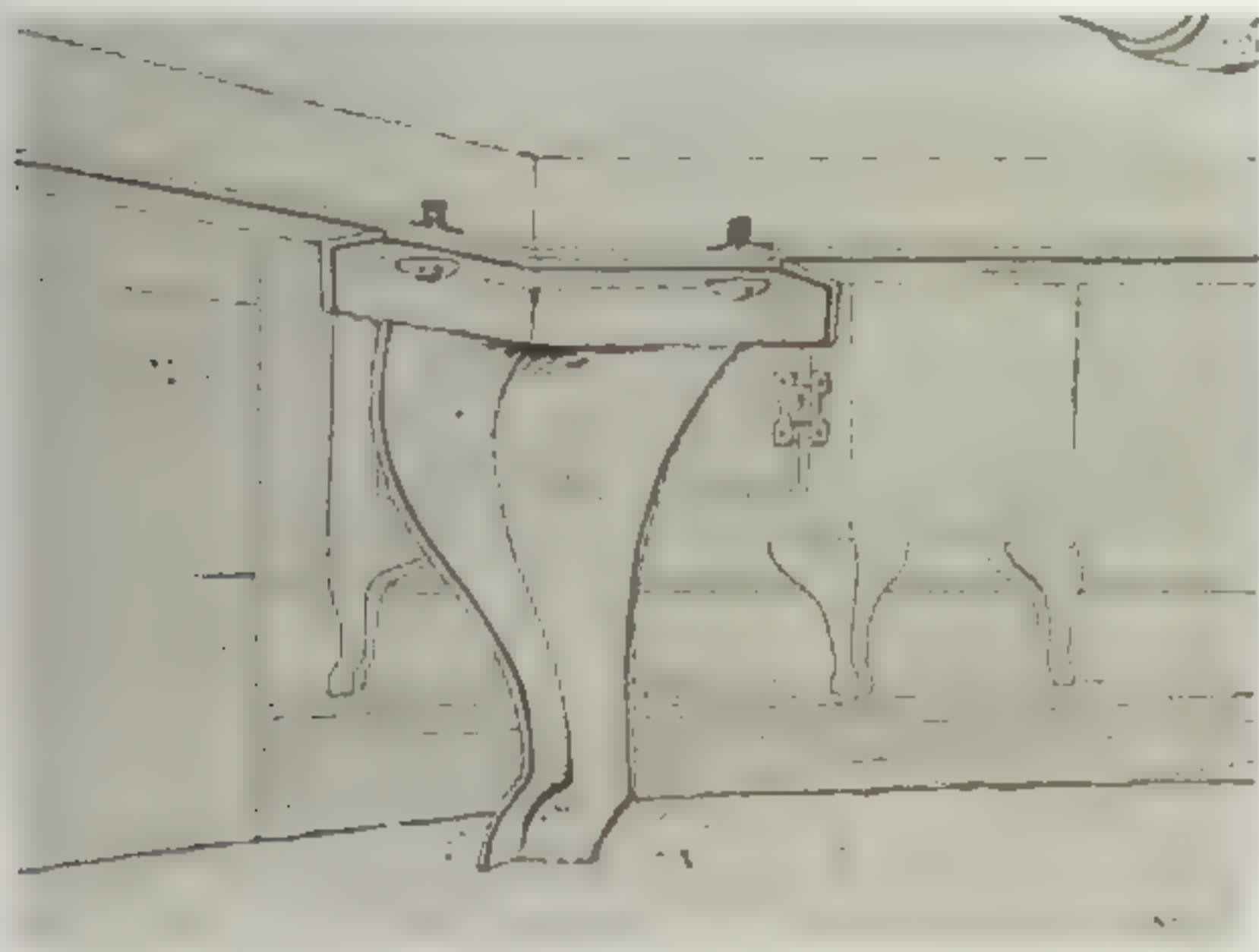
One Hundred and One Dalmatians was beautifully laid out. If you look at the drawings of Roger’s apartment, they tell you everything you need to know about Roger, and you don’t even have to see Roger to know who Roger is. It’s clear he’s a bachelor, it’s clear his interest is in music, it’s clear that he spends a lot of time working. And he’s engaged in his work rather than in his surroundings, so they have kind of a messy, haphazard artist thing going on there. It’s very English. The constant cups of tea piled on each other like the Leaning Tower of Pisa? It’s great.



LEFT: The detailing in this low-angle view of the kitchen, seen from Perdita's point of view as Pongo tries to comfort her, gives some indication of the lengths to which the artists were prepared to go in pursuit of authenticity in their designs. This is not a generic cooker; it's a particular type of small, mass-produced domestic gas cooker with modest ornamental claw-feet, attached to the underside by heavy screws.

One Hundred and One Dalmatians (1961) Disney

Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman

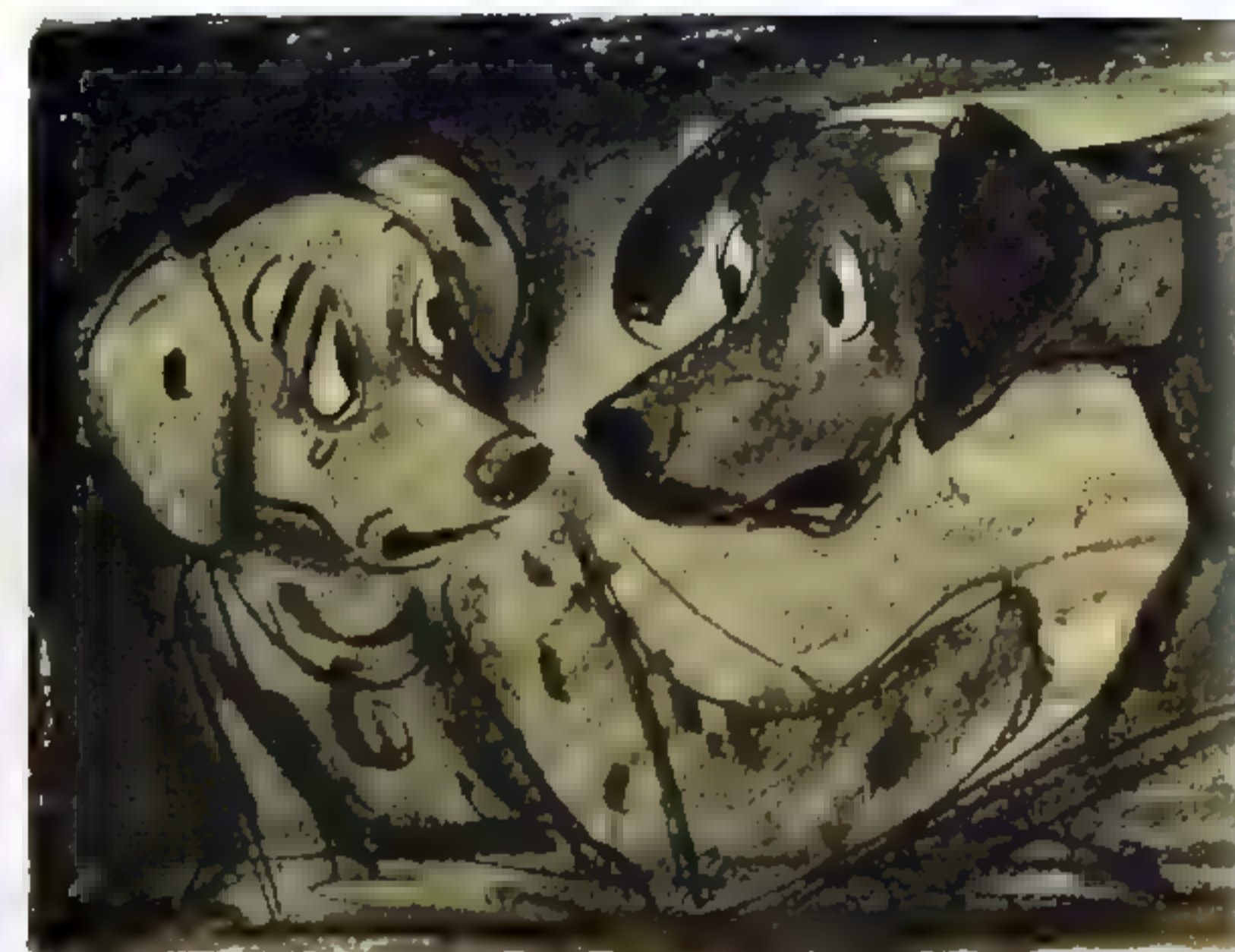
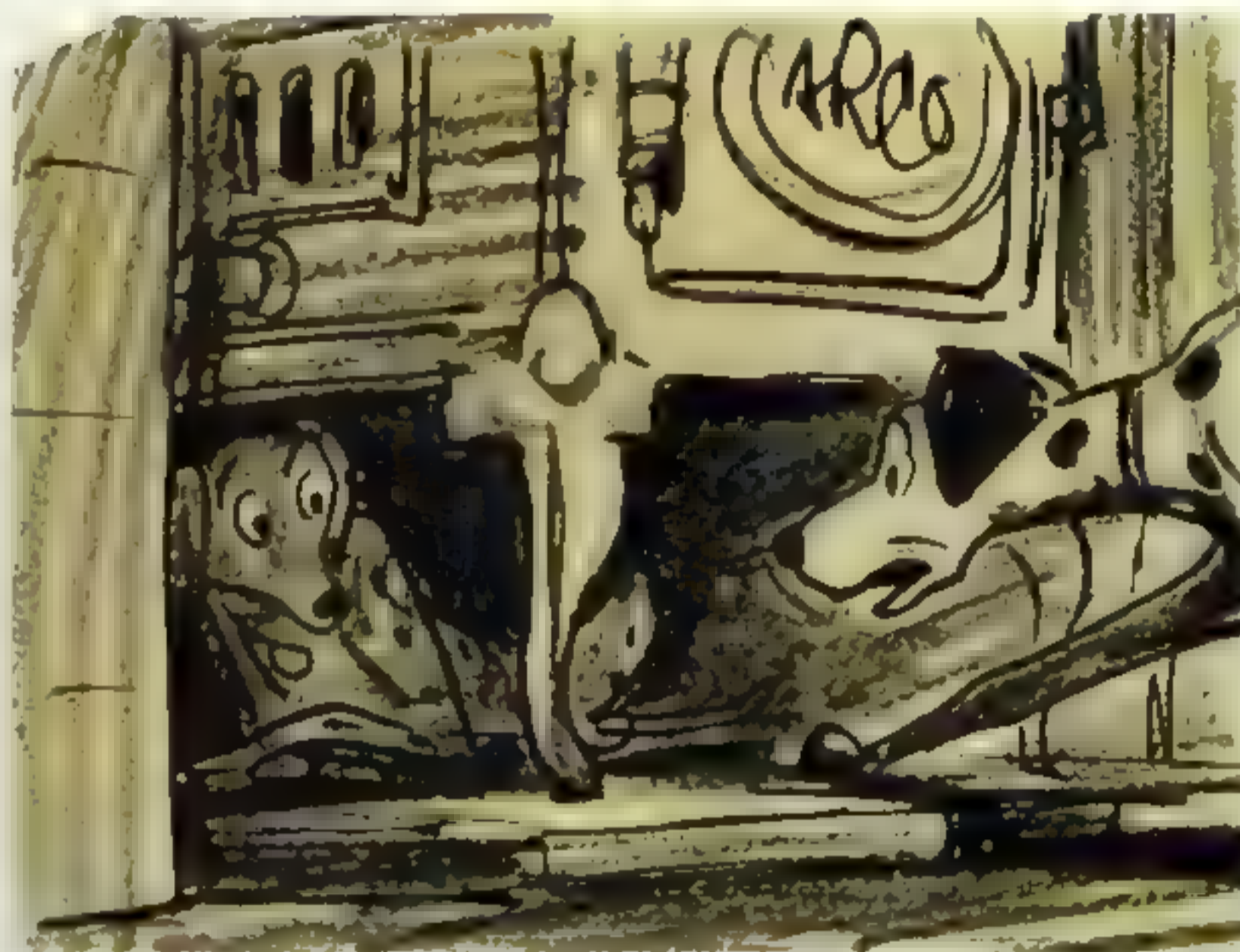


MIDDLE AND RIGHT: As work progresses from preproduction planning through to the specific timing of scenes for the filmed story reel, different types of drawings may appear on the storyboards for a sequence; here the dynamic, gestural drawing of Bill Peet's rough sketches contrasts with the precision of the final, cleaned-up line of the BG layout drawings.

Story sketches by Bill Peet

One Hundred and One Dalmatians (1961) Disney

Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman



By the end of the brief, scene-setting “bachelor” sequence, both the main characters have found love and in no time at all we see the two young couples settling down to enjoy married life in a modest and peaceful terraced house in north London. We care about what happens next because we care about our “good guys” and we care about these particular good guys because we’ve been thoughtfully introduced to the world they inhabit with all its appealing imperfections.

A STAGE WITHIN A STAGE: ROOM TO PERFORM

At certain key points in the unfolding of a film’s narrative, the filmmakers may want to isolate an area *within* a background painting or set model so that a lead character can declare something of importance to the story. In the case of a villain this usually means outlining his or her evil intentions—but whereas a regular theater audience knows to accept certain conventions such as the “speech from the front of the stage,” in cinema there is no “front of the stage” because there is no stage.

The *Dalmatians* layout team even provided Marc Davis’s blatantly theatrical Cruella De Vil with her own miniature “proscenium” within which she could hit some of the key performance “beats.”

To either side of this “stage,” the modest charm of Roger and Anita’s home is subtly heightened so that we are even more taken aback at the behavior of the intrusive, self-centered villain.

KITCHEN THINK

In everyday life we go to the kitchen when we want to prepare a meal, and we climb in our cars when we need to drive somewhere. Characters in movies get into cars so they can have conversations that advance the plot and, even when they go to the kitchen to cook, they do so because the story requires it. In MGM’s *Tom and Jerry* series, the kitchen forms part of a domestic environment which is part playground, part assault course. A feature-length movie, on the other hand, needs to support a longer, more complex narrative, so the writers, directors, and designers need to work together from the outset to establish a plausible context in which the story can come to life. They have to provide a world that the audience will feel is both believable and worth exploring.

In Roger and Anita’s house, just as the living room is not a living room (it’s a stage against which the human couple’s lives can be turned upside down) and the attic is not a dusty space full of

discarded objects (it’s a creatively chaotic retreat from which Roger is free to poke fun at the villain), down in the kitchen, the gas cooker is identified not as a practical necessity but as a source of warmth and retreat for the puppies’ mom-to-be, Perdita.

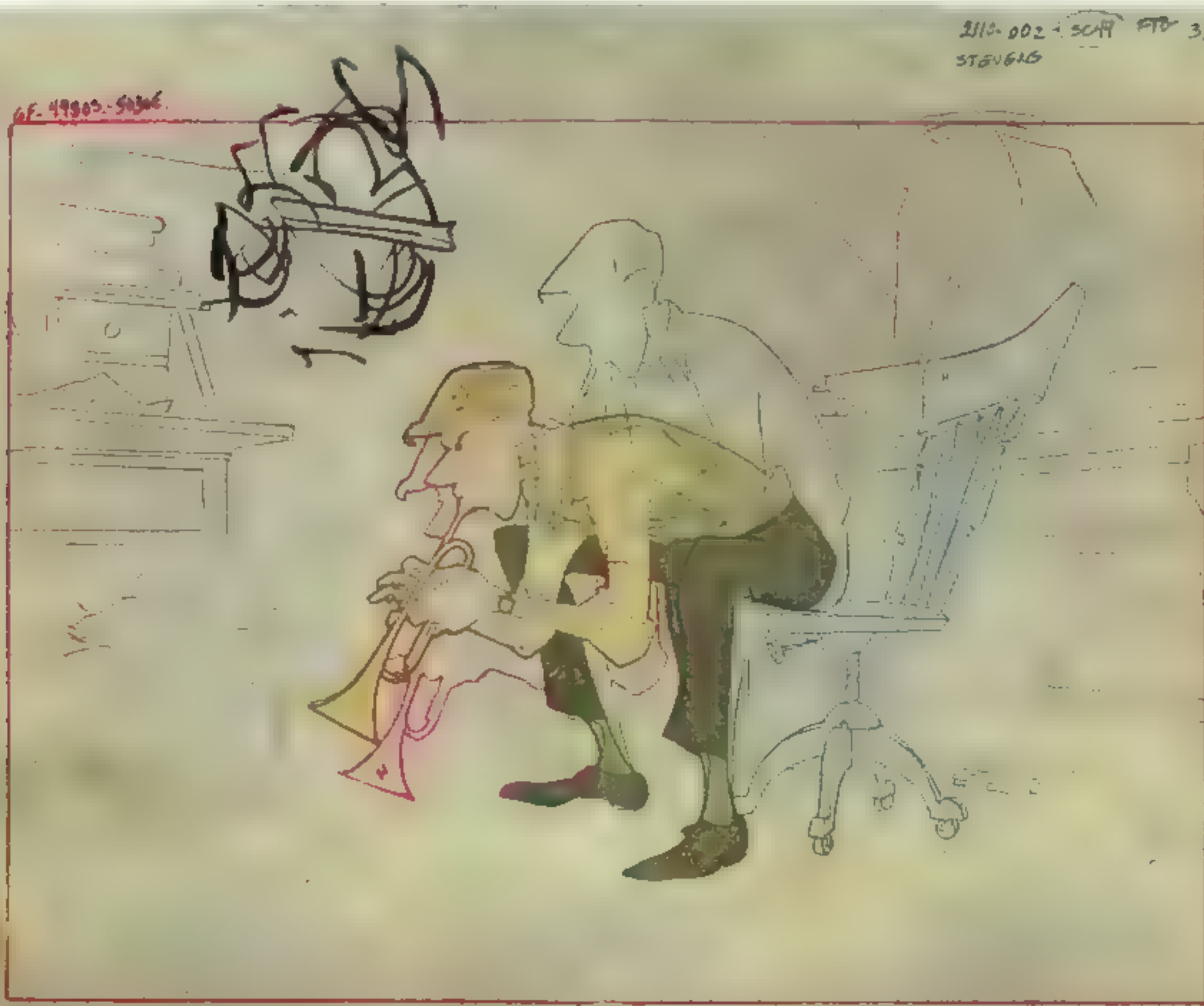
In contrast to the suburban interior luxuries of California in the ’40s and ’50s that *Tom and Jerry* made so familiar, British terraced houses of the Victorian era were built at a time when light and heating, both public and domestic, were all gas-powered. The *Dalmatians* layout designs capture this fact in everything from the street lamps to the metal casing around the interior power cables that snake toward the ceiling from every light switch. They even show the precise way in which each metal leg was screwed onto the underside of a gas cooker.

The scene played out between Pongo and Perdita in *One Hundred and One Dalmatians* is permeated by a sense of powerlessness over future events. By contrast, when we find ourselves underneath the cooker with Remy in Gusteau’s kitchen in *Ratatouille*, the whole sequence is charged with the urgent and desperate need of a single character to escape immediate mortal danger in unfamiliar surroundings.

TOP: The blue (brown and pink) character outlines in this scene of Roger show how the "blue sketch" process helped the different lead animators to establish hookup from one scene to the next. The strong diagonal established in the corresponding shot by Cruella De Vil's arm and cigarette holder is continued here in the position and staging of Roger's animation.

One Hundred and One Dalmatians (1961) Disney

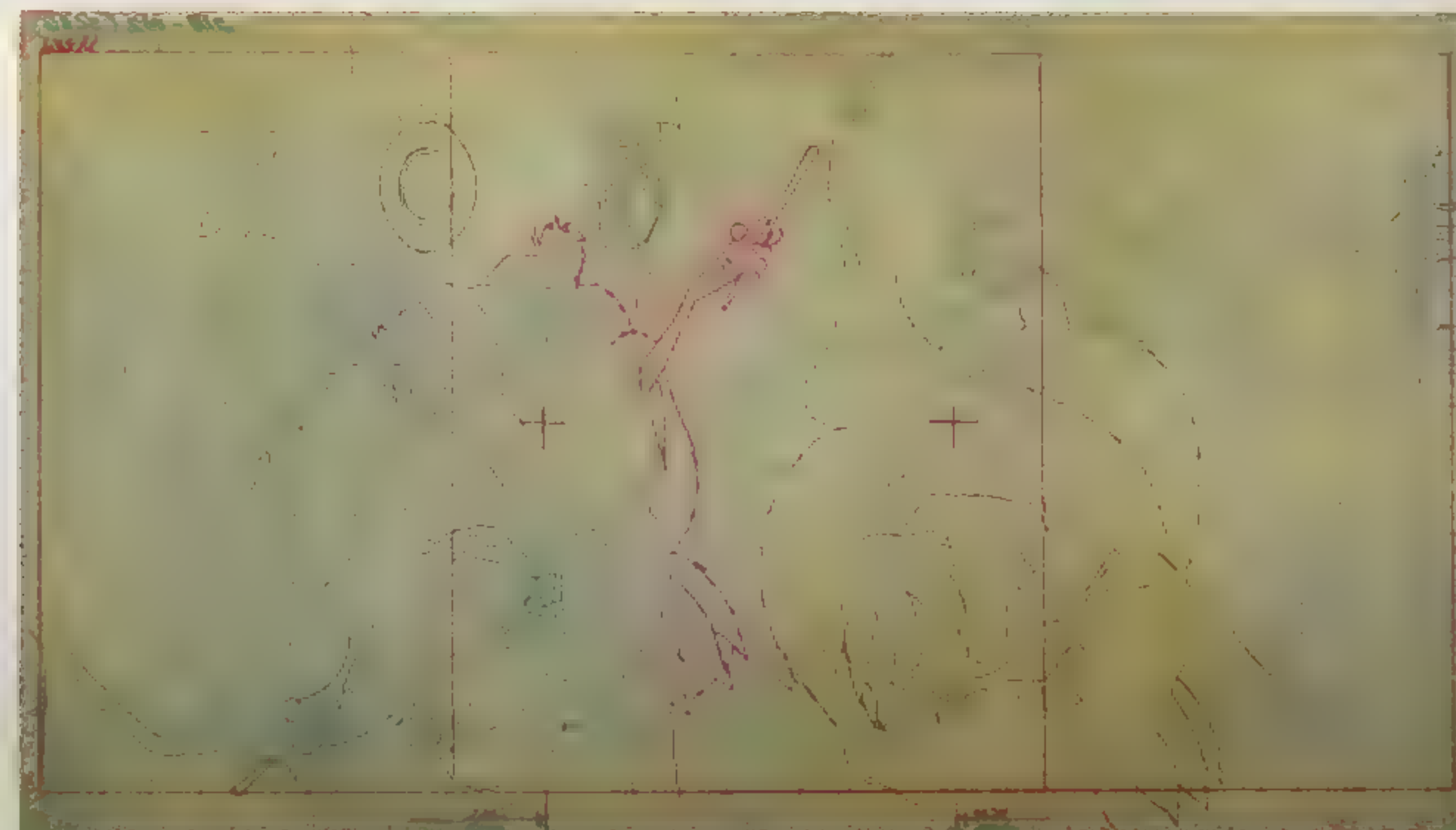
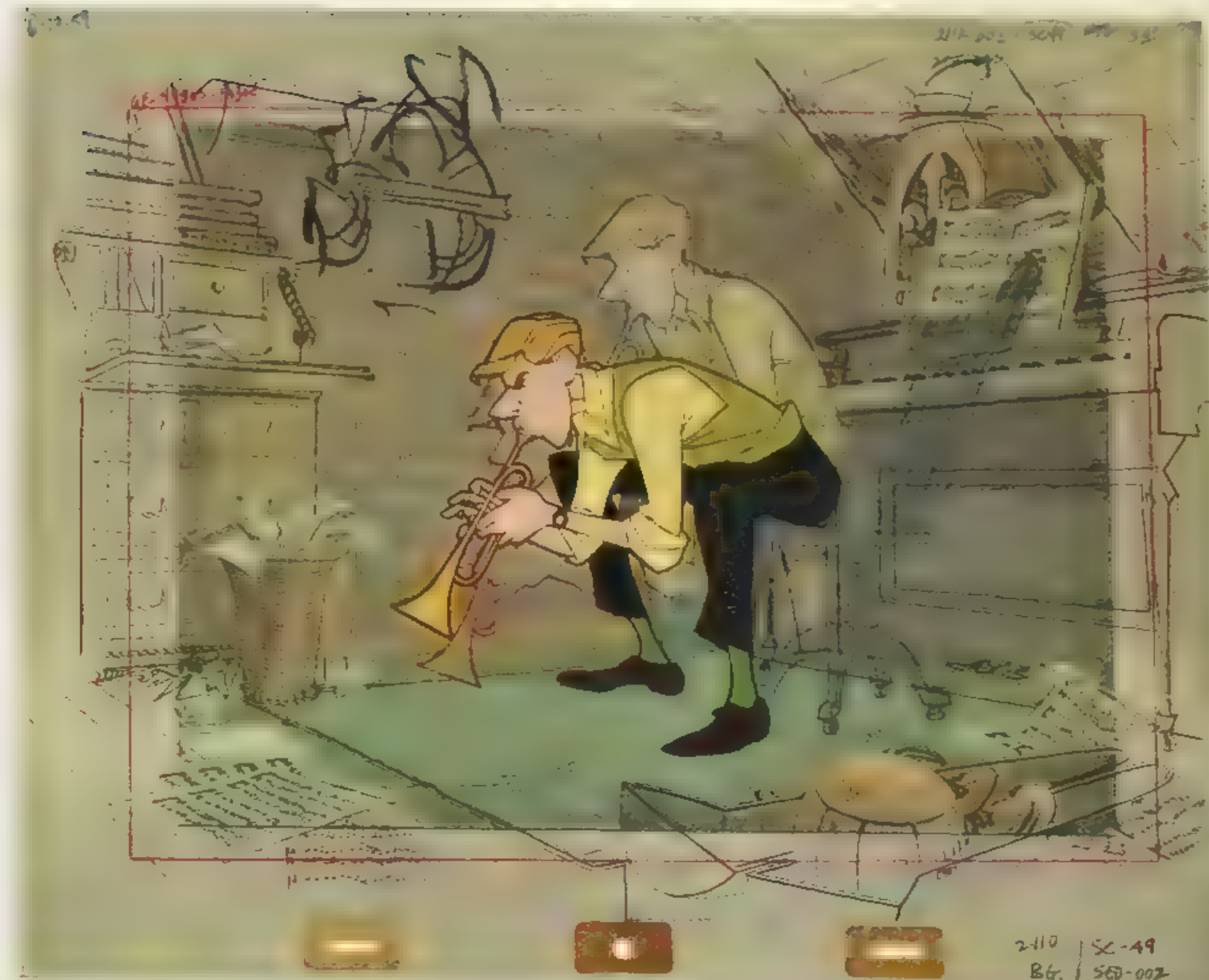
Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman



BOTTOM: Disney introduced a step in feature production known as "blue sketch"; in this example lead animator Marc Davis has traced the outline of Cruella De Vil's four key poses (using four different colors, including blue) to provide the background painters with a clear indication of the full performance area covered by the main character's movements in the scene.

One Hundred and One Dalmatians (1961) Disney

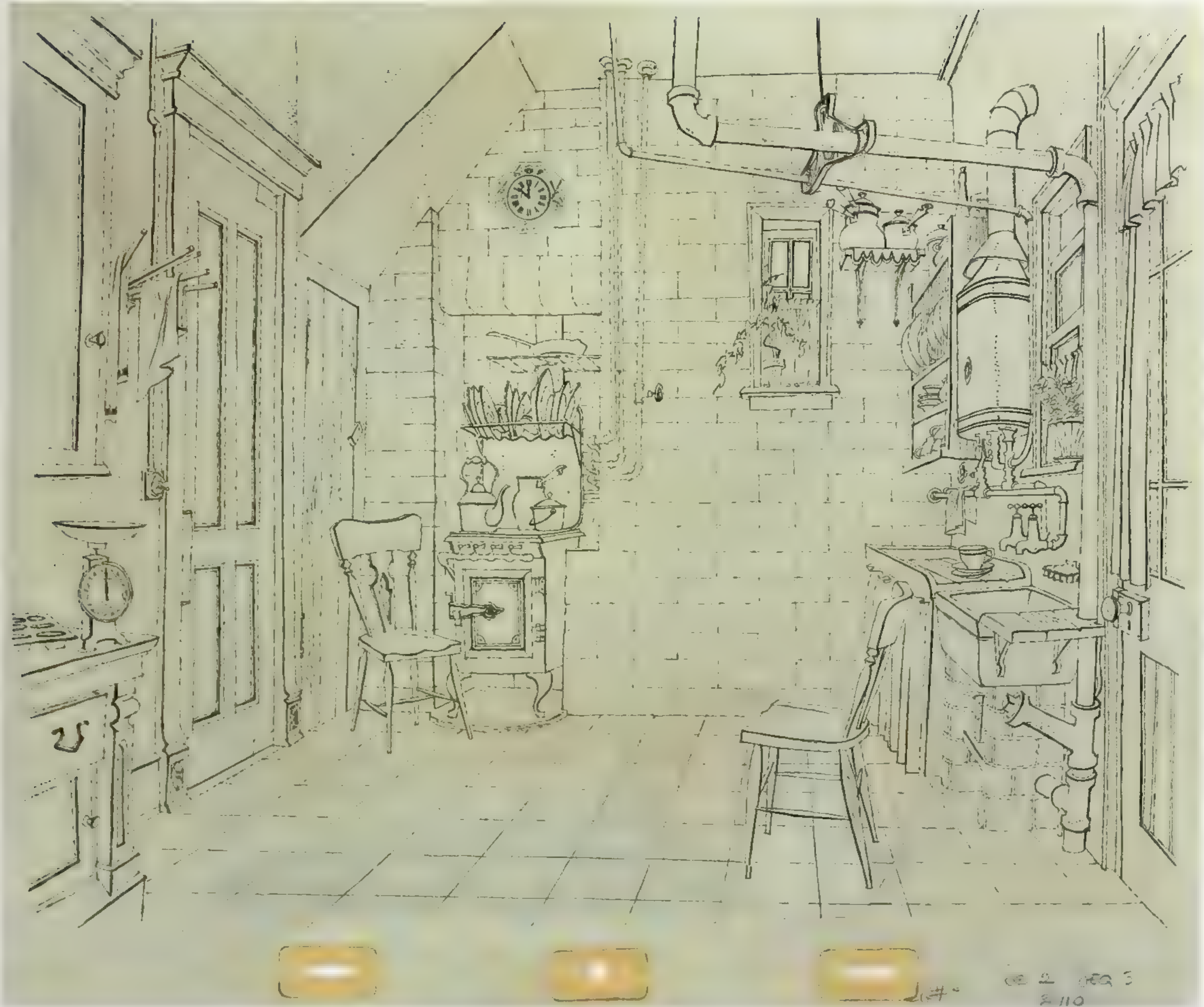
Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman



THIS PAGE AND OPPOSITE: Exhaustive research into the fittings and interiors of specific London terraced houses helped the layout artists on *One Hundred and One Dalmatians* to create true-to-life room designs, wired, plumbed, and furnished in the exact fashion of a 1950s Primrose Hill home.

One Hundred and One Dalmatians (1961) Disney

Directed by Clyde Geronimi, Hamilton Luske & Wolfgang Reitherman





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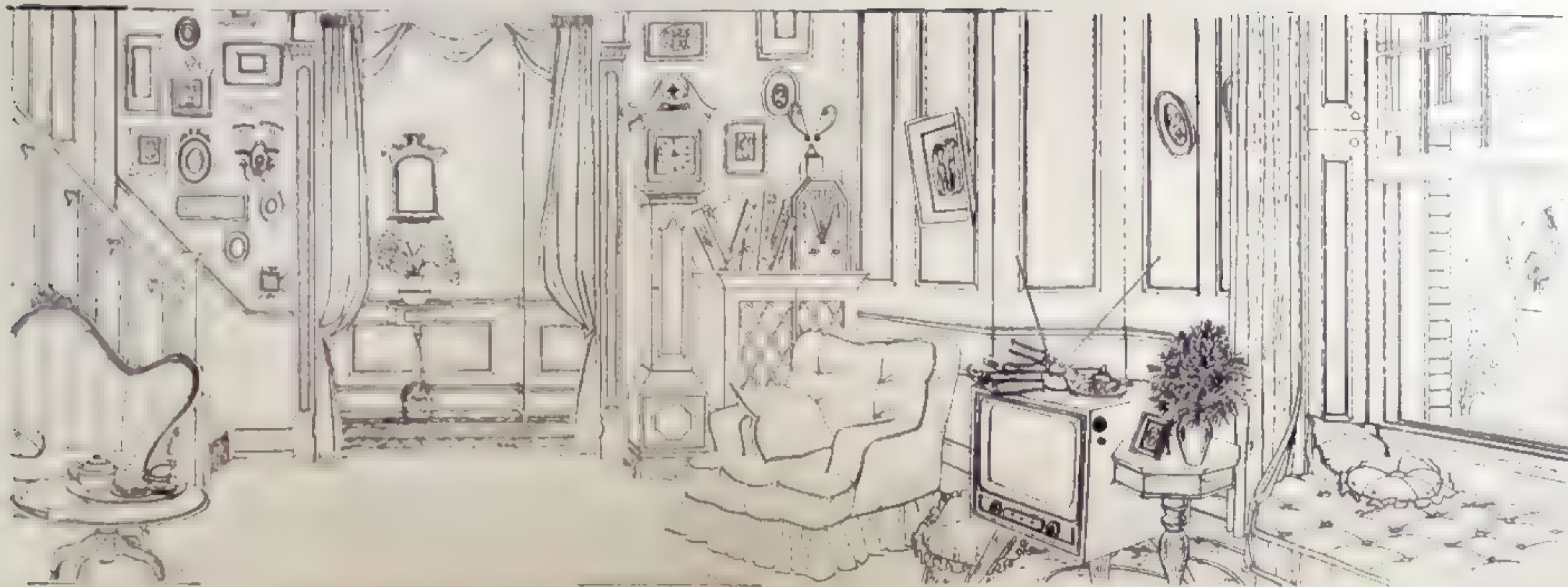
Cruella DeVil is given her own theatrical "proscenium arch" to perform against in Roger and Anita's modest Primrose Hill living room.

TOP BIG layout drawing, ink line on paper (later photocopied onto cell)

BOTTOM Walt Peregoy's color artwork, designed to sit beneath the cel/cel line

One Hundred and One Dalmatians (1961) Disney

Directed by Clyde Geronzi, Hamilton Luske & Wolfgang Reitherman



TOP, LEFT AND RIGHT: The *Tom and Jerry* kitchen is “part playground, part assault course.” Regardless of the character’s size within the frame, the audience can follow Jerry along his path of action, to and from the fridge, from wide shot to close-up and back, thanks to the use of the same dominant diagonal line in the composition of the layout.

The Midnight Snack (1941) MGM Cartoons

Supervised by William Hanna and Joseph Barbera

BG painting by Robert Gentle

Layout by Joe Barbera

BOTTOM: Before these miniature interiors were photographed, great care was taken to “light the set” exactly as the lighting director might light a full-scale set for a theater production—or as a live-action cinematographer might work with light sources on a movie sound stage.

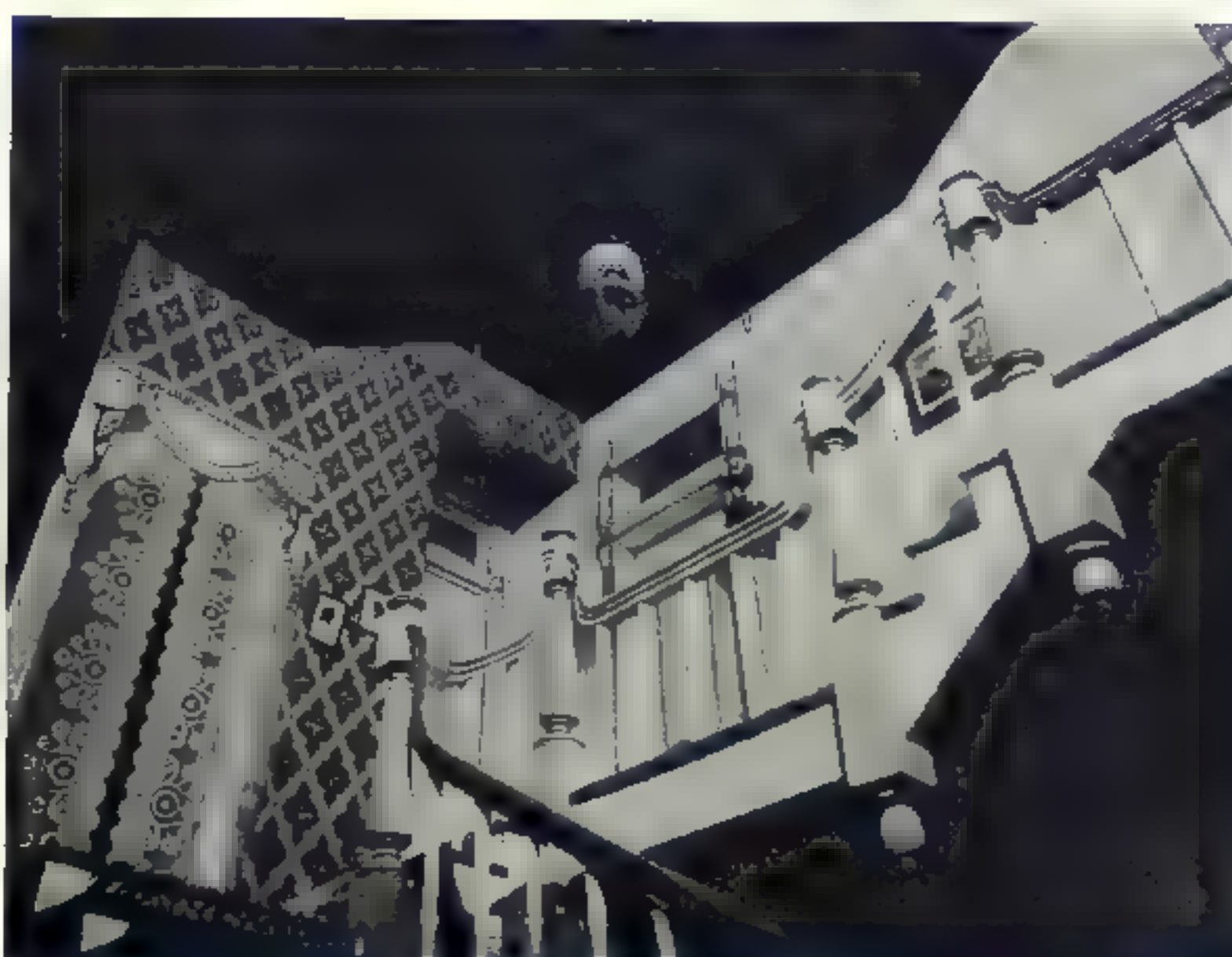
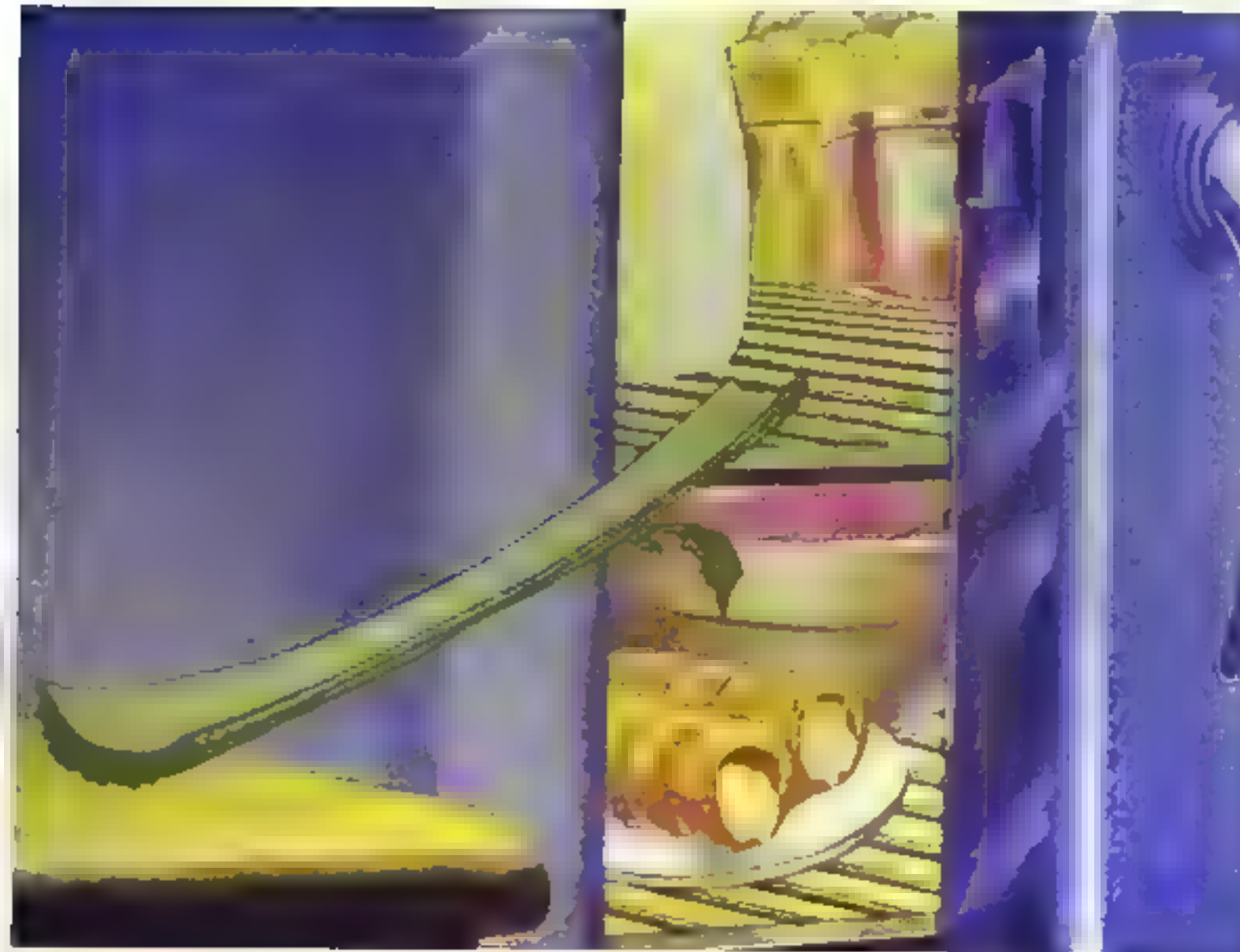
BOTTOM, RIGHT: An extraordinary level of detail was included in this scale model of the stairway, designed to be photographed as a reference for both perspective and potential camera angles.

LEFT: Scale model of the hallway in Jim Dear and Darling’s house.

RIGHT: Scale model of the staircase in Jim Dear and Darling’s house.

Lady and the Tramp (1955).

Directed by Clyde Geronimi, Wilfred Jackson & Hamilton Luske.



CHASING AND SNEAKING

However many times we see the same armchair pass as Tom chases Jerry round the living room, the gag itself is still going to “read” to us, just as the precise spatial relationship between the canyon precipice and the highway is of no real importance in the fatalistic physics of the Coyote’s desert world. In the longer format of features, the designers must, by stealth if possible, provide the audience with a mental map that grounds them in the imaginary world alongside the characters. The designers have to be both intelligent and respectful about the relative positions, not only of the objects within one environment, but of the separate dramatic spaces within the wider world of the story being told. As Brad Bird explains, using an example from yet another Disney feature:

There’s a wonderful sequence in *Lady and the Tramp* where Tramp comes into the house. It’s dark and the lightning illuminates him as he comes to the bottom of the stairs. Ken O’Connor laid out that sequence, and that’s a great example. He understood that house and the way the rooms were arranged so, early on, you get a very clear sense of the geography of the place.

Basically a lot of modern filmmakers are trying to cover up for a lack of skill in conveying geography, and a lot of times in an action sequence you don’t know what the hell is going on because it’s fast and there’s cutting and it’s all punched up to where it’s engaging on a sort of caveman level, but you can’t feel as much suspense or involvement because you have no idea if these guys are five feet from each other or ten feet from each other.

In *Ratatouille*, for example, the drama of the sequence depends on maintaining a sense of the geometry of the interior through the confusion

TOP SIX PANELS From Rough Layout Review Notes, 01/12/06: Make sure there's a storytelling shot in here that shows Remy's thought of "How am I going to get to the window ... ?"

BOTTOM THREE PANELS The steam should motivate Remy's turn to the soup; you have to remind the audience what's in there.

Storyboard panels for Remy's attempted escape from Gusteau's kitchen ("Big Break" sequence)

Ratatouille (2007) Disney/Pixar

Directed by Brad Bird

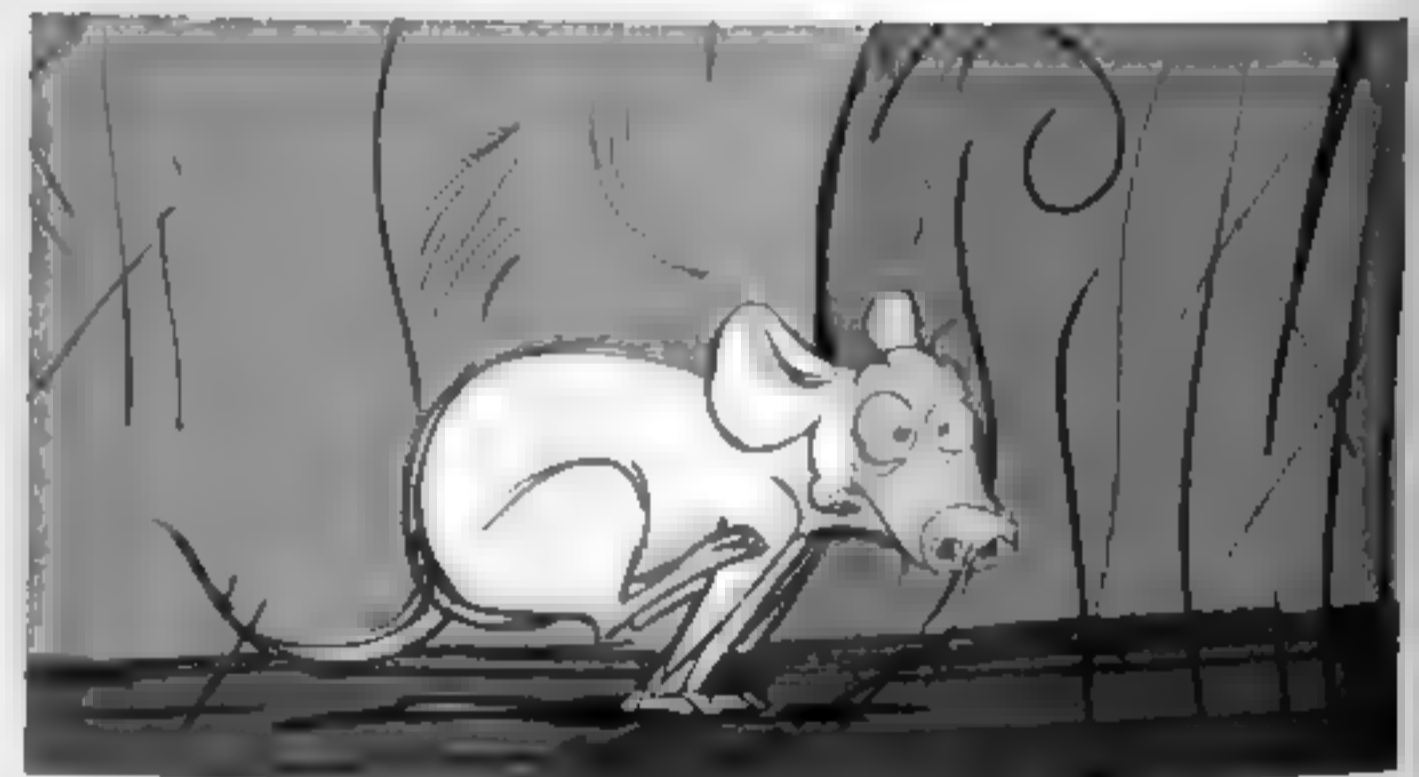
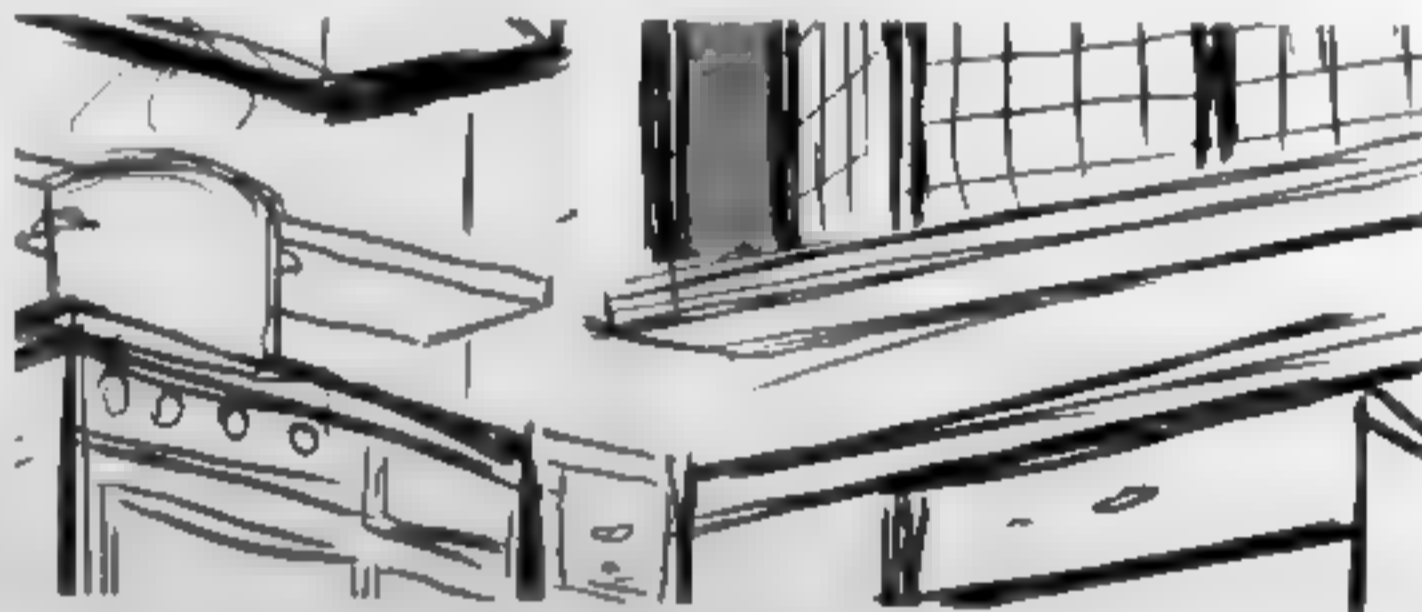
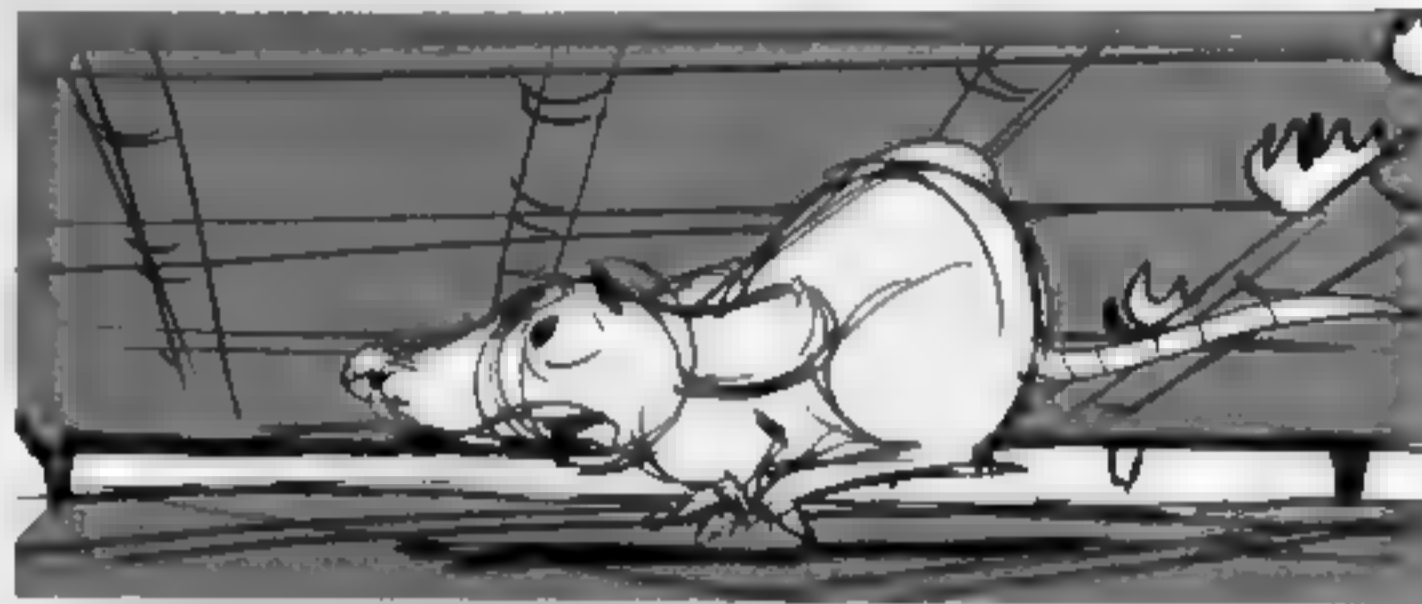
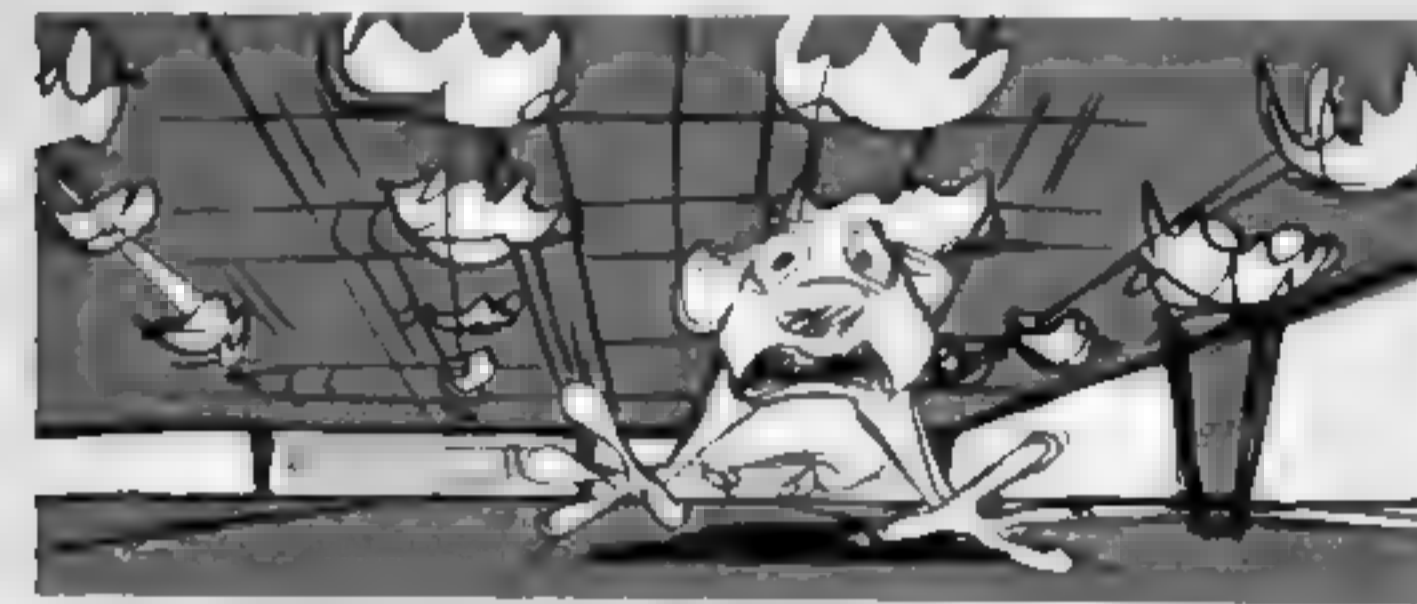
TOP (ALL THREE) Josh Cooley

CENTER (ALL THREE) Josh Cooley

BOTTOM, LEFT: Josh Cooley

BOTTOM, CENTER: Ted Mathot

BOTTOM, RIGHT: Enrico Casarosa



BELOW: "The mantra [for the staging and storyboarding of the 'Big Break' sequence] was, 'Always be able to check back with the window. Where's the window?'" (Brad Bird)

Digital development painting by Dominique R. Louis
for the 'Big Break' sequence
Ratatouille (2007) Disney/Pixar
Directed by Brad Bird



of an elaborately choreographed chase, so the filmmakers prime the audience for Remy's escape attempt by first sharing with them his detailed prior knowledge of the kitchen's floor plan. By providing a point-by-point description of every workstation, corner, and hot plate, the writers have helped the layout team to orient the audience firmly in a world which, though strange and new, remains clearly legible throughout a series of fast edits and deliberate about-turns. As Brad Bird went on to explain:

That sequence was very carefully laid out to be on the floor with Remy and keep with him and *experience* this kitchen, which is a nice-size kitchen but it's not at all a big room. We had to make it feel like it was a world.

There were some tremendous challenges as far as keeping the audience clear on where everything was. The mantra was, "Always be able to check back with the window. Where's the window?" because we don't want to lose the idea that he wants to get out and we want to show him getting seduced to the point where he's finally at the window and he's lost all interest in escape.

When Bob Parr arrives home after dark, cautiously letting himself in through the kitchen door in the "Bob Sneaks" sequence from *The Incredibles*, the audience knows what his wife, Helen, can only suspect: having pretended to go out bowling with his buddy, Frozone, her husband has once again given in to the temptation to exercise his superpowers (in this case to save people from a burning building) even though their family life will be turned upside-down if the authorities ever find out.

For additional comic effect, the scene is played out as though it were leading up to a more familiar

Although the blue character outline in this sketch shows Helen on the phone and Jack Jack bathing in the sink, this view of the Parr home kitchen, pictured in daylight, was eventually chosen to open the later nocturnal "Bob Sneaks" sequence, the window in the kitchen door framing Bob's silhouette perfectly as he attempts to slip in, unnoticed, through the back door.

Development sketch by Scott Caple
The Incredibles (2004) Disney/Pixar
Directed by Brad Bird

dramatic confrontation, that of the wife challenging the husband to confess that he's been cheating on her. To emphasize Bob's guilt (and to make sure he gets caught, quite literally, "with his hands in the cookie jar"), the filmmakers bait a very clear trap for him on one of the kitchen countertops. Instead of tiptoeing directly through to the living room, Bob stops to retrieve a large slice of chocolate cake, which, as originally 'boarded, would have sat beyond the left edge of the frame. Because the camera lens is kept level with the foreground countertop the audience discovers the clear plastic cake container at the same time as the main character. In the final version of the scene, having experimented with the relative positions of Bob, the cake, and a floating breakfast bar that, in some early sketches, sits across his path, a direct path of action is cleared so that Bob can stride directly into the line of fire as Helen spins round in her armchair, ready to confront him in the interrogation beam of the reading light next to her.

Nothing is neutral or decorative in any of these three kitchen scenes. Everything has been carefully designed and laid out for a unique and specific dramatic purpose.

LIGHTING AND COLOR

Many of the artists Disney hired to work on *Snow White* and *Pinocchio* were chosen specifically because of their background in illustration, so when either Gustav Tenggren or Albert Hurter created a design for a location or a scene, all of the pictorial information governing the composition, geometry, staging, and lighting would be coming from one brain, traveling down one arm, and arriving on the page via the brush, the pen, or the pencil.

When the Pixar team first moved into feature production with *Toy Story*, the creative and technical crew they assembled faced similar challenges



to the crew that had been brought together to make *Snow White* sixty years previously. As seems to have happened subsequently at many of the studios who decided to follow Pixar's example, the notion of animation artists multitasking in this way proved problematic in the context of a heavily departmentalized CG production pipeline that was already well established and, for very good reason, highly specialized.

"DON'T YOU NEED A PLAN FOR THAT?"

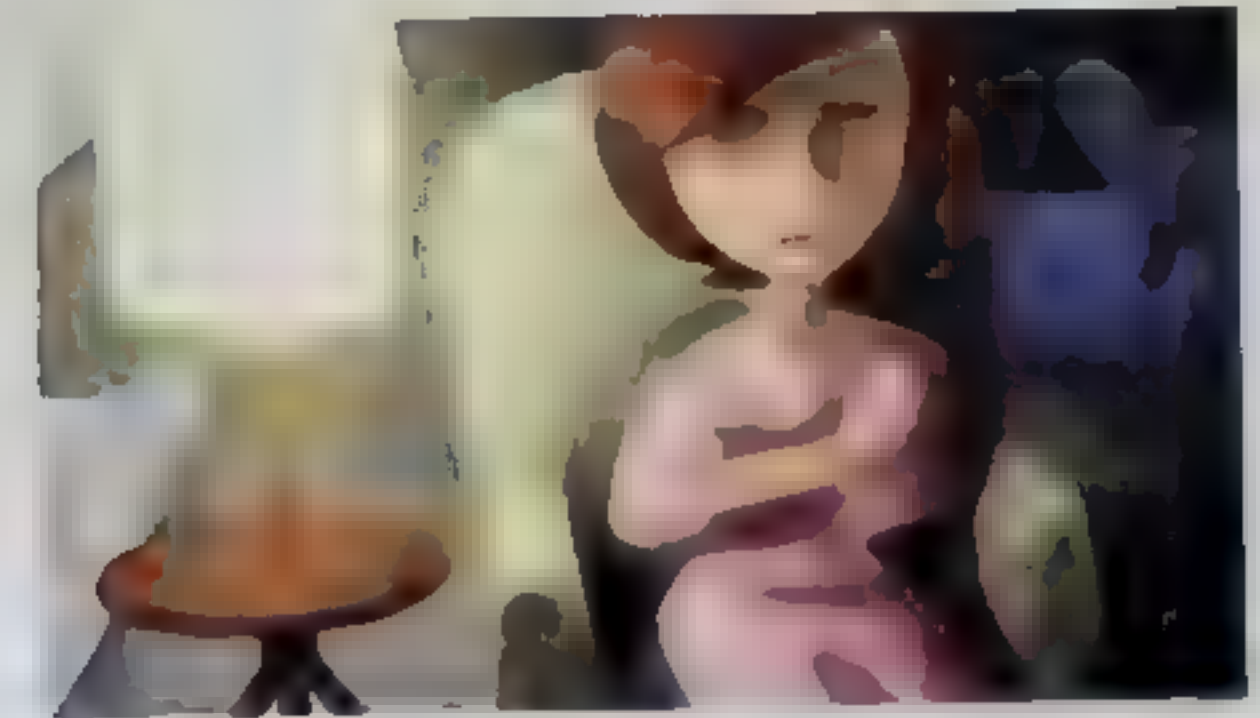
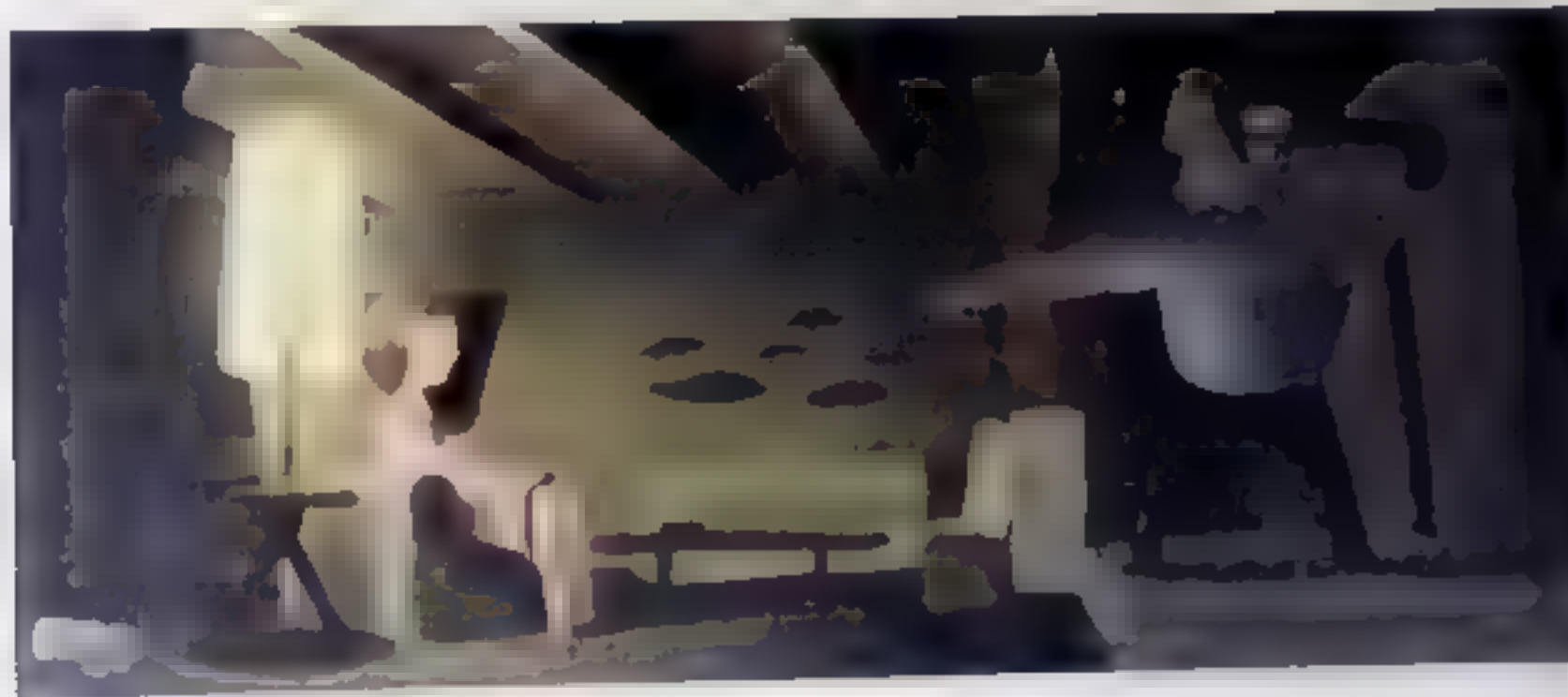
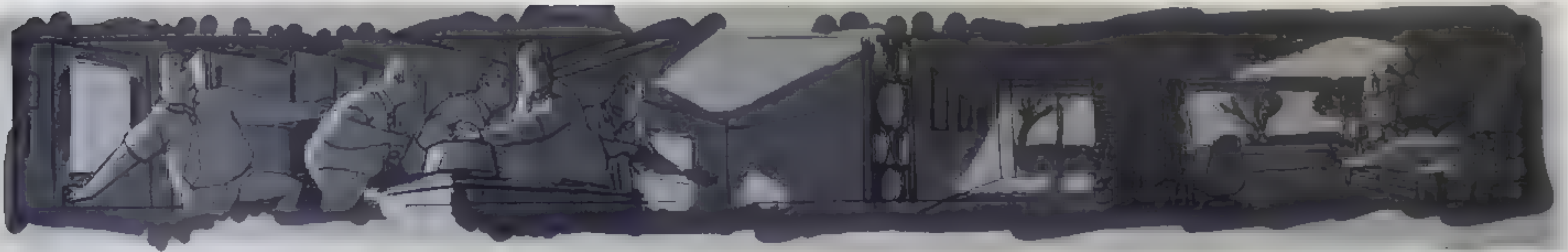
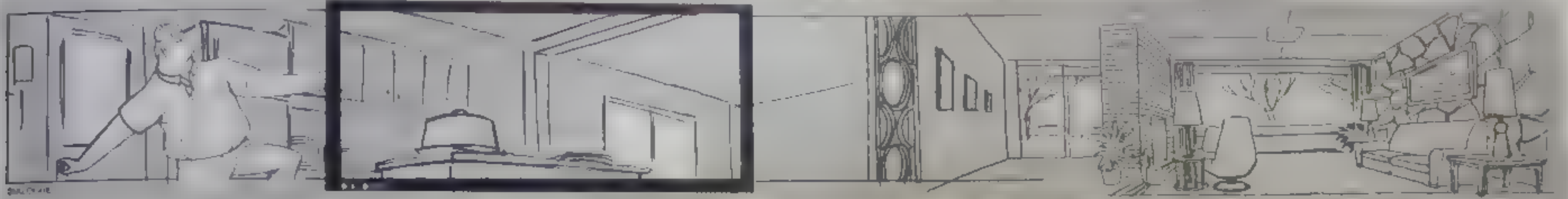
The first indication I had of this particular problem came halfway through my first interview with Rob Cardone, who moved from Disney in L.A. to head up a brand-new Layout team at Blue Sky Studios in New York, where the first *Ice Age* movie was about to go into production:

When I first got to Blue Sky I said, "OK, here's what Layout does! We set up this and we set up that and then you know, we do a tonal lighting

TOP Diagram showing the early Layout thinking, which brought the camera lens down to the level of the kitchen work surface to allow the scene to continue in profile – as soon as the audience has registered the “face on” establishing shot of Bob coming in the kitchen door. By switching to this set-up, we see the chocolate cake at precisely the same moment as Bob does.

MIDDLE Another example of lighting for a scene being worked out in a rough drawing, before the light sources and rendering choices are finalized using the CG toolkits

BOTTOM Two of Lou Romano's lighting thumbnails for the “Bob Sneaks” sequence in which the position of an otherwise ordinary table lamp helps to cast Helen as the interrogator



BELOW: The training that most illustrators and commercial artists would have enjoyed in the first half of the twentieth century included all the "classical" techniques painters had been using since the Renaissance; the Disney layout artists' command of chiaroscuro, perspective, and composition can clearly be seen in this beautiful drawing.

Clean-up layout drawing of Geppetto's workbench for sequence 1A in *Pinocchio* by Disney Studio Artist (possibly by Albert Hurter)

Pinocchio (1940) Disney

Directed by Hamilton Luske & Ben Sharpsteen



GEPPETTO'S WORK BENCH
PINOCCHIO - F 3
SEQ. 1A.

LAYOUT DEPT.

M72-A
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LEFT: As Rob Cardone recalls, "The idea was for the city to be made up of what we consider to be small objects in our world, so the design of Robot City is based on what you would see if you were to open up the back of a watch, with the layering of all the inner workings and the sprocket wheels. In the layout design, the city blocks were tone arms and you see buildings shaped like oil cans, giant lug nuts, and things like that. Old radiators and everyday household metal objects became giant structures and buildings in the city."

Development artwork by Greg Couch for *Robot City* (2005)

Directed by Chris Wedge & Carlos Saldanha

plan and we figure out what the light direction should be and what the shadow shapes should be and all that."

And as soon as I started to even talk about lighting, the hands went up and everybody was like, "Whoa! Whoa! Wait a minute! We have a whole department that does that!" So I said, "Well, yeah, but don't you need a plan for that?" Because lighting is 50 percent of the composition of a shot, and if you're talking about composition, you're talking about layout.

For many people, as Rob discovered, "drawing with light" only has meaning at those stages in the CG process when drawing itself is required. When you're working with virtual light in a digital environment, hand-rendered 2-dimensional artwork is something to which technicians and digital artists refer for guidance along the way; it's not an end in itself.

The move to fully computerized feature-length animation production therefore brought about a peculiar collision of sometimes mismatched practices from the already established and largely separate worlds of live-action moviemaking, traditional hand-drawn animation, and the often more academic approach of computer graphics research and development. The resulting dislocation, unapparent to many, was keenly felt by those moviemakers who, like James Williams, had started off in traditional animation and now found their own work, and that of the artists around them, being redefined:

Having Lighting and Cinematography as two separate departments, which normally don't have much communication, can be very detrimental because you can reveal a character through lighting just as much as you can reveal them through physically moving the camera into that character's position.



TOP In this preproduction drawing, the artist has created an intimate, sheltered domestic space in the root end of a fallen palm tree while keeping a wealth of fine detail in check with a clear, overriding tonal scheme.

Development drawing by Marcelo Vignali of the Big Z Shack
Surf's Up (2007) Sony Pictures Animation
Directed by Ash Brannon and Chris Buck

BOTTOM Despite the bright afternoon sunlight, the upper two thirds of the frame are kept deliberately dark in this composition to allow the character action to "read" against it.

Color concept painting
Surf's Up (2007) Sony Pictures Animation
Directed by Ash Brannon and Chris Buck



TOP By bathing this snowscape in mist and moonlight and allowing the ice buildings to glow like Chinese lanterns, the designers have been able to make all the important detail clearly legible in this nocturnal scene.

*Source: 2007-8 The Art of Disney Pixar
Director: Andrew A. Aikawa*

BOTTOM The dappled lighting in this shot helps to overcome the powerful geometry of the characters whose surface markings, by nature, are made up of large areas of black and white.

*Source: 2007-8 The Art of Disney Pixar
Director: Andrew Aikawa*



Maybe the depth of field is going to reveal an object? How can an object be composed in a non-classical manner? It may look rather awkward on a layout artist's desk but, with a view to how the shot will be lit, it can make complete sense.

When live-action cinematographer Roger Deakins was invited in to advise the Pixar crew during pre-production on *WALL·E*, he too found the sequence of events in the CG animation pipeline difficult to understand. As Danielle Feinberg recalls:

Roger said, "I can't believe that you guys are doing camera without any lighting in there! Part of the whole reason you're making camera decisions is that you're telling a story and the lighting is part of that story, so how can you do the camera without the lighting?!"

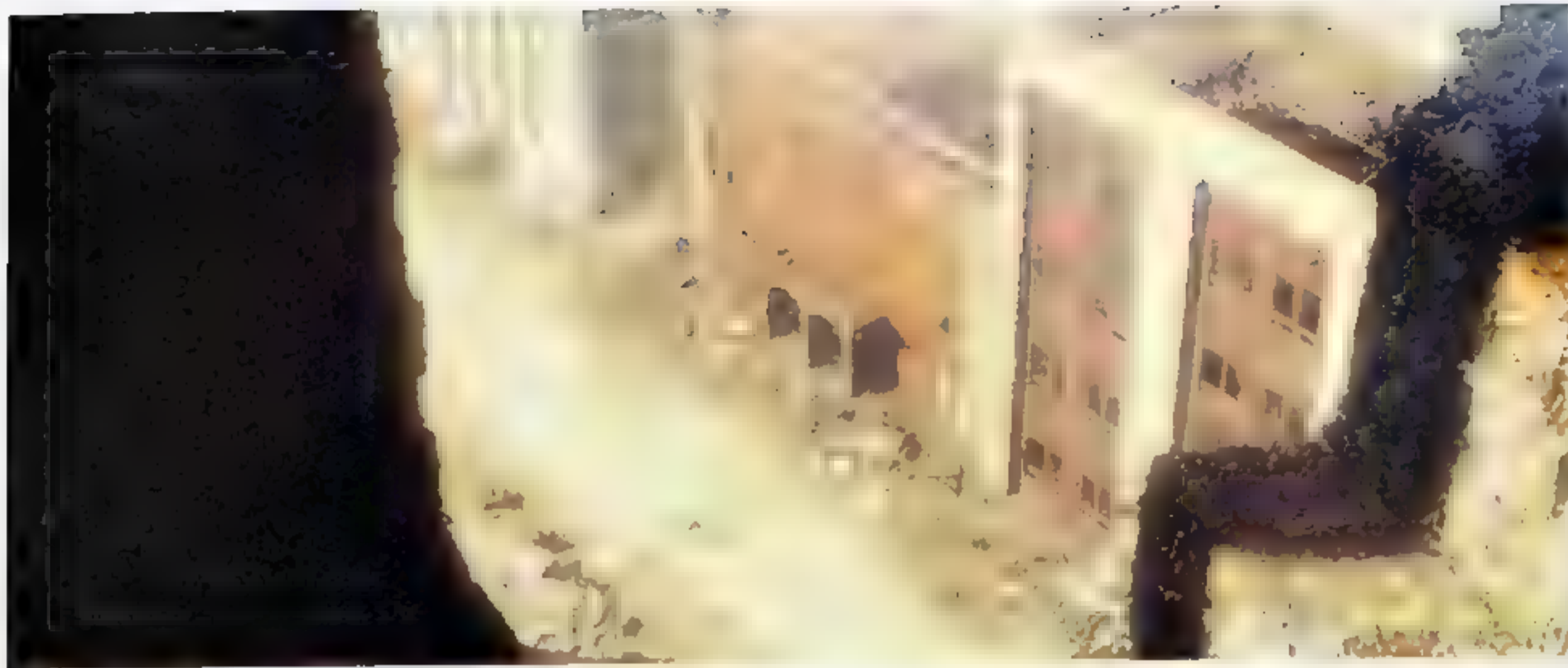
Just as he argues strongly for greater communication between Layout and Story, James Williams insists that Layout work closely with Lighting:

Layout is responsible for character and camera blocking, but we cannot do that in isolation, we have to do that in the context of the scene and of the sequence. We have to work in context with the lighting design, especially with something that has strong lighting elements which create compositional regions of light and dark. It has to be a collaborative process.

Camera movement in the CG environment also leans more toward the problems and practicalities of live-action cinematography as Geoff Darwin of the DisneyToons Previz Department pointed out:

My background was in 2D scene planning and I was really thrilled to get into 3D, but one of the big differences is that the camera person is





TOP Publicity still of the deserted cityscape.

MIDDLE Color key by Ralph Eggleston of WALL-E in the doorway of his home.

BOTTOM Publicity still of rusting robots and debris beneath a giant freeway intersection.

WALL-E (2008) Disney/Pixar

Directed by Andrew Stanton

differentiated from the lighting person. In traditional animation you lay out your multiplane move in a drawn layout, the art director gives the values, it gets painted and away you go! But in 3D, the CG camera rotates, so the lighting values change. You never have that problem in traditional animation scene planning.



Even those animation artists who have worked exclusively in the computer are aware of the need to relate what's happening in the CG environment to something "real" and observed, as Danielle Feinberg explains:

In a certain sense there are too many degrees of freedom. On the computer you can do anything, and if it's used wrongly, that can be a dangerous thing. Take light, for example. If you don't understand the principles of what happens in real life with light, you can very quickly get into something that looks silly. When you sit there and noodle with things, you can really take it into this realm where it's not a believable place anymore, and that distracts from the story.



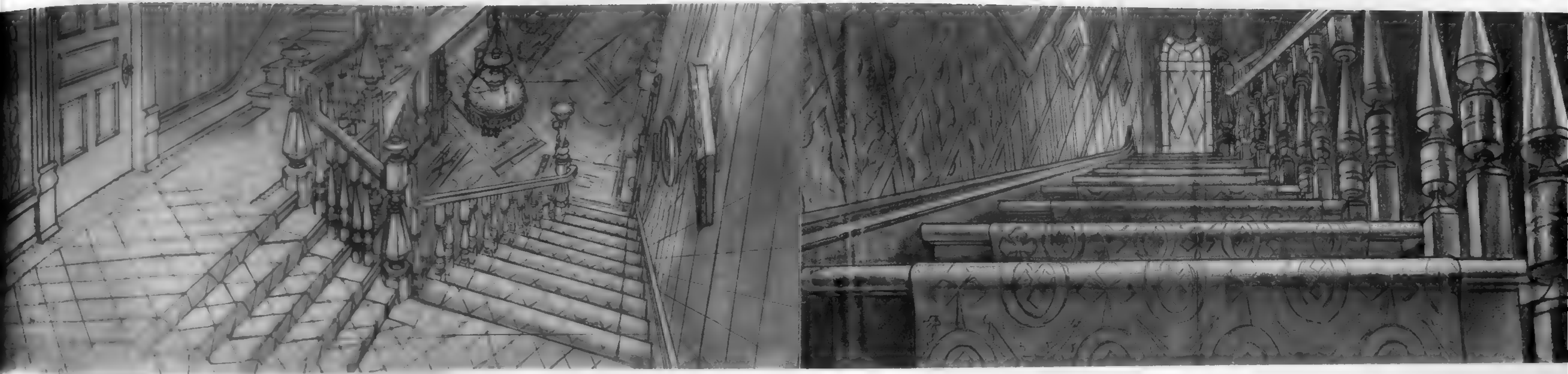
Pixar Director of Photography Sharon Calahan is equally keen to anchor her lighting design in the effects she encounters in the tangible world:

There's a lot of stuff that you get for free with physical lighting that you have to work hard for in the computer. If you really want that bounce light there, you have to add it, you don't get that for free. Sometimes you think, "Oh! It would be nice if the computer could just do that!" instead of, "This leads to that leads to this . . ."

But I'm also not a fan of going the global illumination route because as a painter, as an artist, I want to be able to control that bounce light. I want to

Guided by the care already taken over the lighting and photography of the miniature sets, the layout and background artists could "line tune" the pools of light in their drawings and painted artwork to create clear paths of action for the characters.

The quality of draftsmanship combines with a keen sense of theatrical perspective in this Tramp's-eye view of the carpeted stairway in *Lady and the Tramp*.



Following the long-established classical principles of landscape painting, the sense of distance in this background painting is enhanced by contrasting the pale, de-saturated colors at the horizon with bold foreground shapes rendered in darker tones and warmer hues.

Master background painting of farmyard showing overhead perspective; watercolor (Disney studio artist)
Old MacDonald Duck (1941)
Directed by Jack King





LEFT Color pass on story sketch by Sharon Calahan, original monochrome lighting pass by Mark Andrews.
Ratatouille (2008) Disney/Pixar
 Directed by Brad Bird
 Co-Director Jan Pinkava

color it and influence how bright it is and how soft it is. I don't want the computer doing something for me.

Outside black-and-white cinematography, it's also impossible to consider lighting without addressing color and, as in traditional animation, the color script is used to create definitive "key" scenes, which will establish the required look of each sequence. David Burgess explains the importance all of these lighting choices can have for the character animators:

We usually see the art director's color keys for a sequence pretty early on, and that's always exciting. They're usually very simple and the level of detail that we actually get into the shots isn't there yet, but if you have a key shot it's always fun to track that because they generally start lighting that shot fairly early, since that's going to influence the entire sequence. That's one of those times where you can actually react to the lighting in your animation during the process.

Generally, we finish animating a shot and then we look at it five weeks later in Lighting. Sometimes the glasses may be casting a shadow right across the character's eyes and if you'd known that, you could've adjusted the head a couple degrees to get that shadow up or down a little bit.

DESIGN ITSELF AS A TEXTURE

The significance of the relationship between color and overall design was one of the most important lessons that Pixar artist Scott Morse learned from Maurice Noble:

Maurice was very particular about where texture would be used and where it wouldn't be used. He thought about design itself as texture.

BELOW. By placing the camera lens at sea level the gigantic scale of the attacking robot is emphasized in the lower shot while the Golden Gate Bridge is reduced almost to the scale of a toy when the viewpoint is raised for the wider shot of the robot's confrontation with Insectosaurus.

Frame enlargements
Monsters vs Aliens (2009)
 Directed by Rob Letterman & Conrad Vernon



BELOW. Colorscript by Lou Romano
The Incredibles (2004) Disney/Pixar
Directed by Brad Bird

OPPOSITE, TOP. The blocking out of the tree shapes and rock formations in this striking Ernie Nordli design echoes Maurice Noble's concept of design itself as a texture.
BG painting by Philip De Guard, layout by Ernie Nordli
"Knight-Mare Hare" (1955)
Directed by Chuck Jones

"Texture," in the language of CG production, usually refers specifically to the rendering of surface detail on anything from human skin to rusting metal. Lou Romano, another of the CalArts graduates to pass through the Turner studio on his way to a prolific design (and voice acting) career at Pixar, has been keen to explore Noble's ideas of restraint and economy in the context of digital design, going so far as to employ a flat, "cut paper" approach to colorscript on a CG movie:

The Incredibles was my first CG feature and I was aware that all those surface details would have to be addressed at some point, but I think part of my doing the colorscript the way I did was to approach it in the "anti-" way, to not get overwhelmed by all of that unnecessary detail or information. For me, it was more about, "Let me strip it down to the pure, bare essentials."

In the lighting keys and lighting thumbnails I referred back to the colorscript and got more of that volumetric information and also some of the shading detail into those paintings. I even toyed with the idea of doing more volumetric colorscript early on, but then hit on just doing pure flat color to convey emotion. For me, a colorscript really is all about emotion. I thought, "We really don't need any of that other detail, I know it's going to come later."

The sheer persuasive clarity of Romano's designs for *The Incredibles* belies the fact that a decade earlier, during the development for *Ray Gunn*, a Brad Bird feature project that was subsequently shelved, he had struggled to come to grips with working in color. Harking back to very much the same traditional design principles espoused by Maurice Noble's generation of animation



MIDDLE, LEFT: The cel overlay of the banisters in this down-shot is all the more powerful for being rendered in black even though it undermines the traditional notion of hookup (or visual continuity) with the color scheme of the surrounding scenes.

BG painting by Philip De Guard, layout by Maurice Noble
Drafty, Isn't It? (1957)
Directed by Chuck Jones

MIDDLE, RIGHT: By working with the same cel paints that were used on the character cels, Maurice became "a real master of making it (color) work right out of the bottle," to quote Scott Morse.

BG painting by Philip De Guard, layout by Maurice Noble
Drafty, Isn't It? (1957)
Directed by Chuck Jones

BOTTOM: Both of these images demonstrate the importance of strong tonal values, established first of all in monochrome. The repetitive "rhythm" of the right-hand composition also underpins the monotony of the work implied by the brooms and trash cans.

BOTTOM, LEFT: Colorscrip by Lou Romano
The Incredibles (2004) Disney/Pixar
Directed by Brad Bird

BOTTOM, RIGHT: BG painting by Philip De Guard, layout by Maurice Noble
Drafty, Isn't It? (1957)
Directed by Chuck Jones

designers, Bird eventually suggested an important and helpful intermediate step. In Lou's words:

I was having a hard time with color, and Brad challenged me and said, "For the next two weeks, just do all of your artwork in black-and-white." I'd done some of that in assignments at CalArts, but it was really fun. We looked at a lot of film noir and all kinds of black and white movies and it really freed me up just to focus on lighting value and composition. And it never left me. It's implanted in my brain.

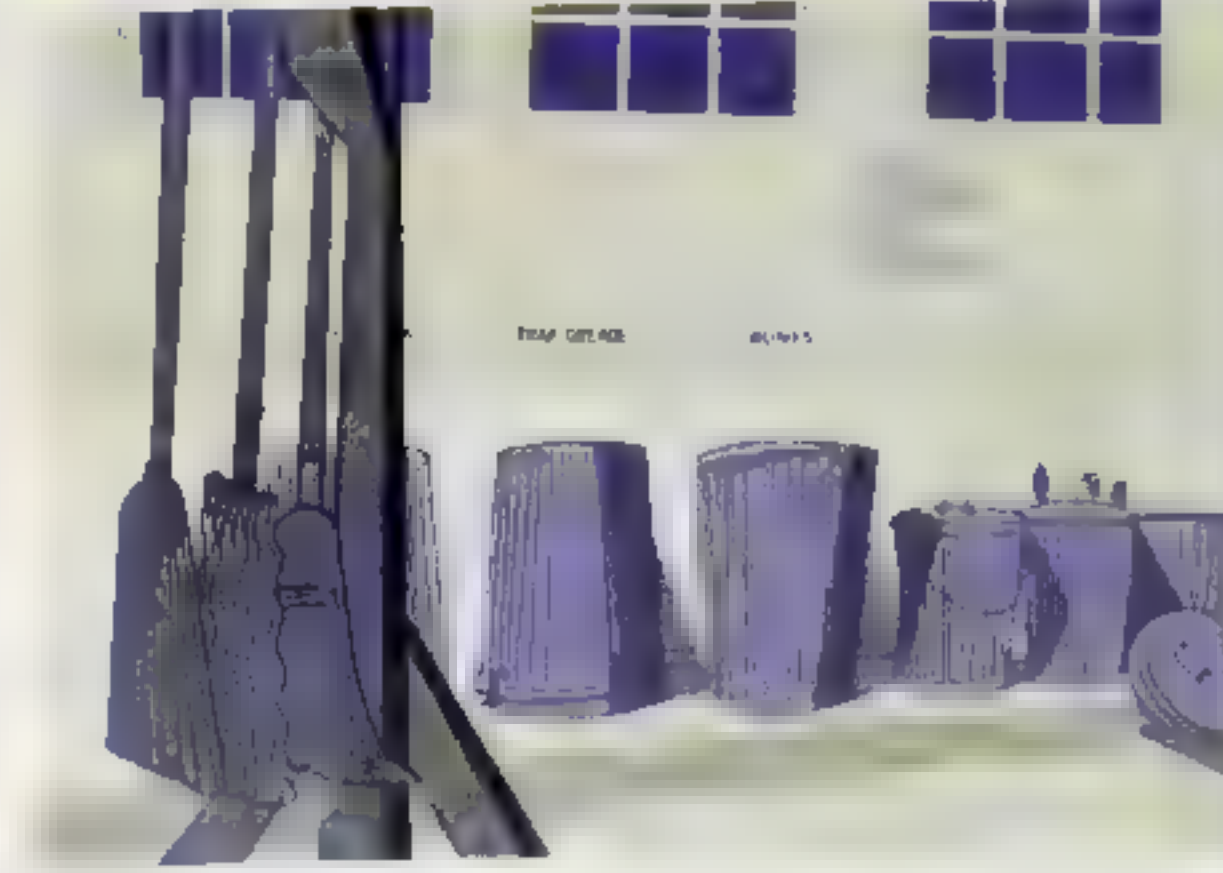
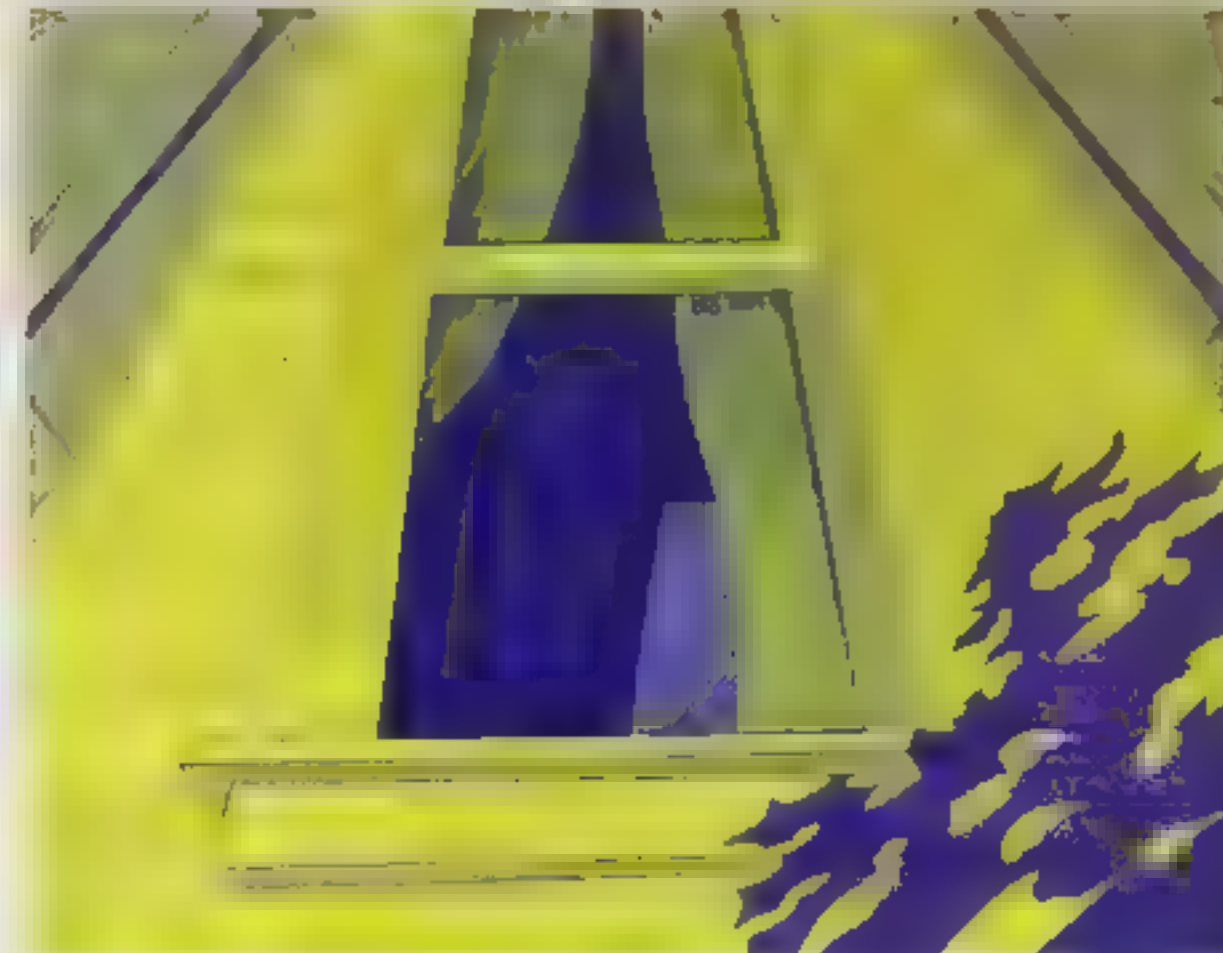
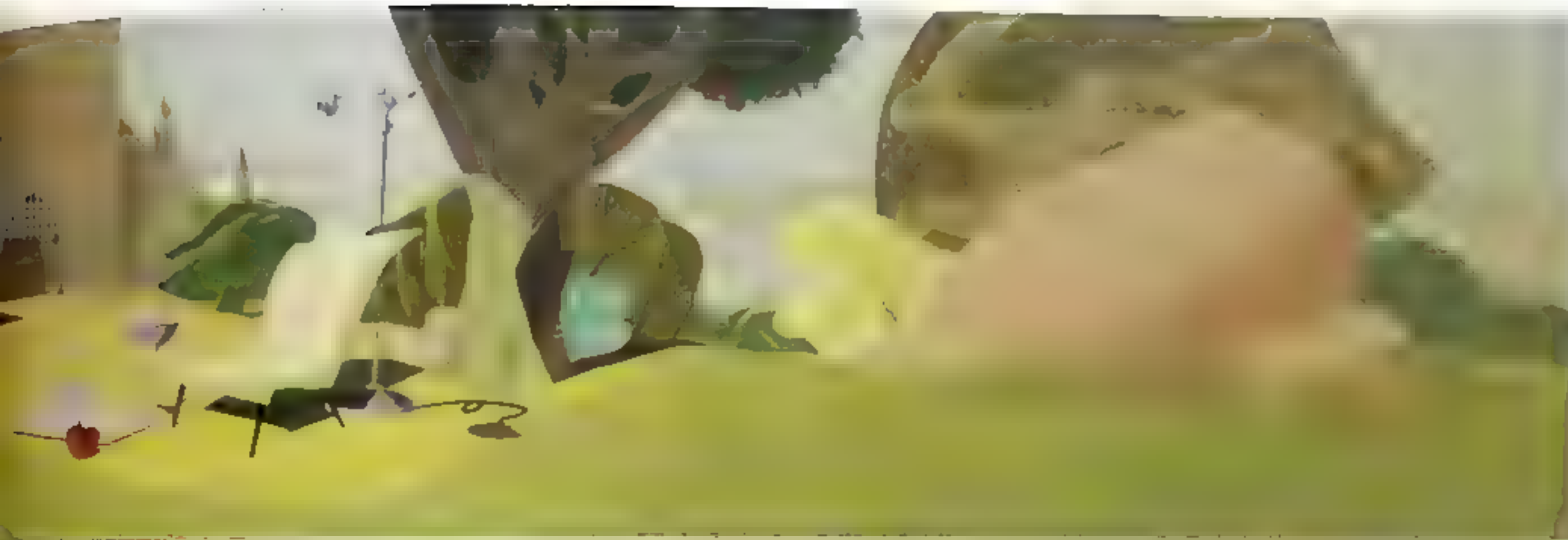
MAKE THE COMPOSITION SING WITH COLOR

In his many conversations with Scott Morse, Noble himself endorsed the same clear approach to lighting. Although, for him, there was less of a need to create a separate step of working in monochrome:

Maurice had a real sense of getting the tonal values to work, but using color at the same time, not just doing a black-and-white tonal drop-in. He could drop in major foreground elements and they would be darker or lighter depending on the shot. As long as it worked as a framing device. But he was a real master of making it work right out of the bottle! "This is purple against pink for this and purple against bright red for that . . ." And, you know, first time out, he'd do the sketch and then he'd just start dropping in the color. He made the composition sing with the color.

Endnote

1. See glossary.



9

RIDING THE BOOM

SOME THOUGHTS ABOUT CAMERA MOVES

We began by thinking of animation cinematography as “drawing with light,” and then watched as both pencil and light source disappeared from the equation to be replaced by, well, an equation.

In spite of this, the central challenge of layout remains unchanged: how do you frame and illuminate moving images in order to tell a story? Whatever kind of camera we use and whatever materials we point it at, the lens will be capturing images that we hope will trigger the kind of response in an audience that will make them identify with and care about the characters whose decisions and actions drive the narrative we are asked to portray. With this in mind, it’s unsurprising that there should be so much agreement among artists, technicians, and directors about the central importance of the device that captures the light and provides the framing: the camera.

Chris Wedge believes that good cinematography taps into all the accepted classical traditions of fine art and commercial design:

All of the principles of composition and lighting and color and contrast that we’ve seen in paintings and photographs over the centuries—it all applies. And we all carry around a bundle of stuff that we know and, even though we don’t necessarily remember where it came from, it informs our decisions as we go.

In considering how an animation camera should move and respond in order for the audience to feel fully involved, James Williams is prepared to extend the comparison beyond pictorial art:

The closest analogy for me is literature. One of the first things that a writer has to do is determine from whose perspective he or she is writing: Is it a first-person perspective? Is it a third-person perspective? Is it a character within the story that’s telling the story? Does that point of view change from chapter to chapter? Can you tell the same story from two different perspectives and



still have the audience understand what’s going on? We’re essentially doing the same thing. When you determine where the camera should be, you are saying, “Is the audience going to be emotionally involved?”

Though he has been at the forefront of digital animation cinematography, James does still permit himself the occasional nostalgic thought:

The more Layout learns from live-action, the more we are shackled to the same process as live-action in terms of lens choice, in terms of position of camera. We were wonderfully free not to have to think about all that so much in traditional animation.

It’s a point reiterated by Pixar’s Ralph Eggleston:

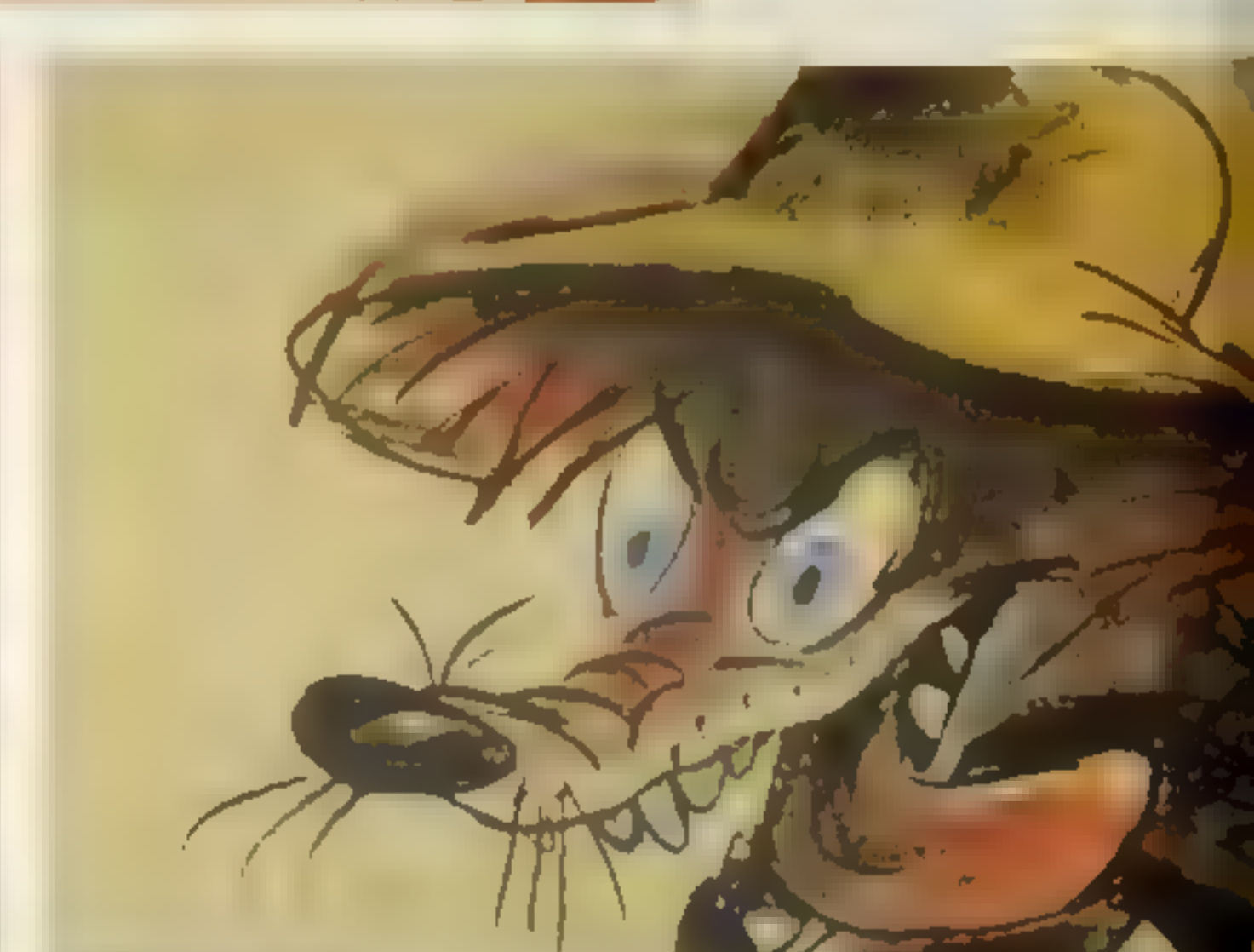
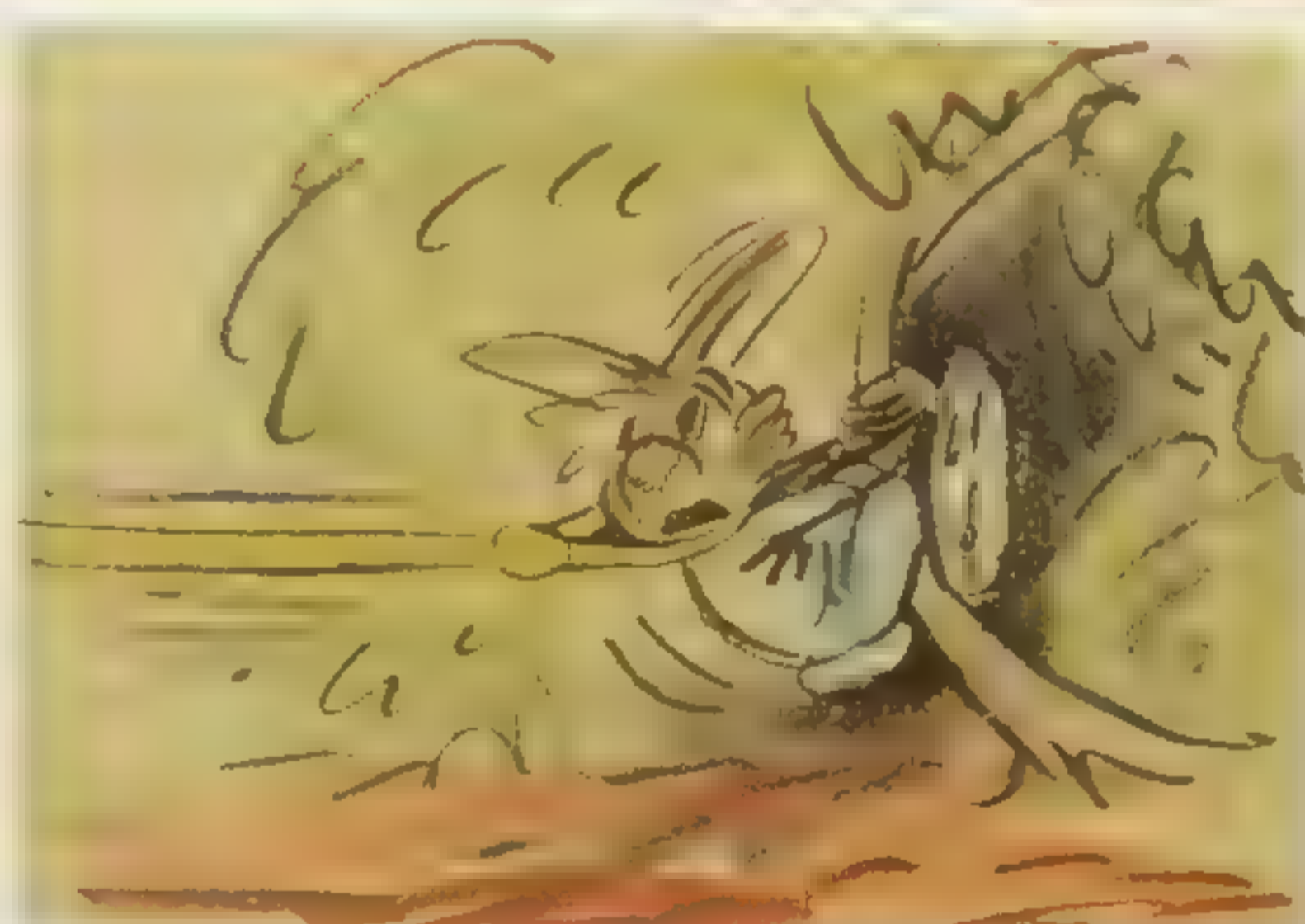
When you’re working in traditional animation, your “lens language” is what you draw.

The “wonderful freedom” James talks of was, of course, derived in part from a demanding discipline: that of creating the impression of movement and depth by preparing artwork to be photographed by a fixed camera. Though locked into the restrictive world of rostrum photography, the story and layout artists who forged the new medium of feature animation at Disney had to be able to imagine the view a child might have if, for example, they could fly over London at night. Bill Peet, Jr., told me how, after years of designing for a fixed lens, his father had taken the opportunity, some years before *Peter Pan*, to leave the ground with a live-action camera for the first time:

When he was doing *Song of the South* my father rode the boom for the camera to see how the live-action shots would look, so he could better integrate the animation.

The freedom animators now enjoy in terms of unlimited camera movement in a virtual environment requires discipline, too. As Lee Unkrich points out:

In CG you can move the camera wherever you want, you can do whatever the hell you want with it, it can fly everywhere, it can zoom in and out.



PREVIOUS, LEFT: Original BG and character layout combined (layout artist uncredited, possibly Tex Avery or Dick Bickenbach) Scene 27, *Magical Maestro* (1952) Directed by Tex Avery

PREVIOUS, RIGHT: *Girl Reading a Letter in an Interior* (1908) by Peter Vilhelm Ilsted

A lot of people were doing that kind of thing early on because they could—and because they didn't have any discipline and they didn't have any education in how to move a camera and they hadn't thought about it. So in a lot of early CG that we remember you got motion sick because the camera was just flying around everywhere.

Craig Good effectively landed the job of layout supervisor on *Toy Story* because he shared Unkrich's distaste for gratuitous camera movement:

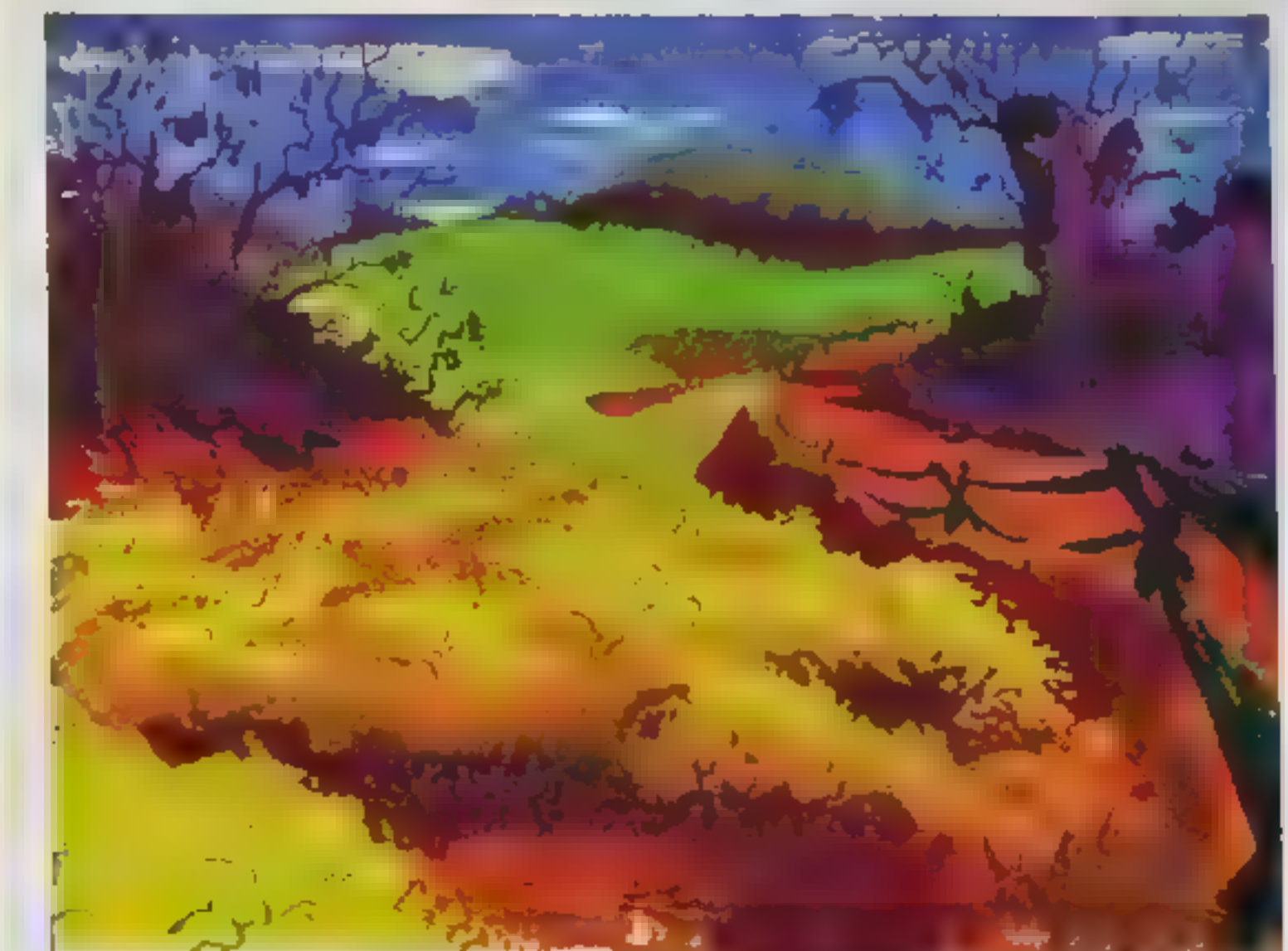
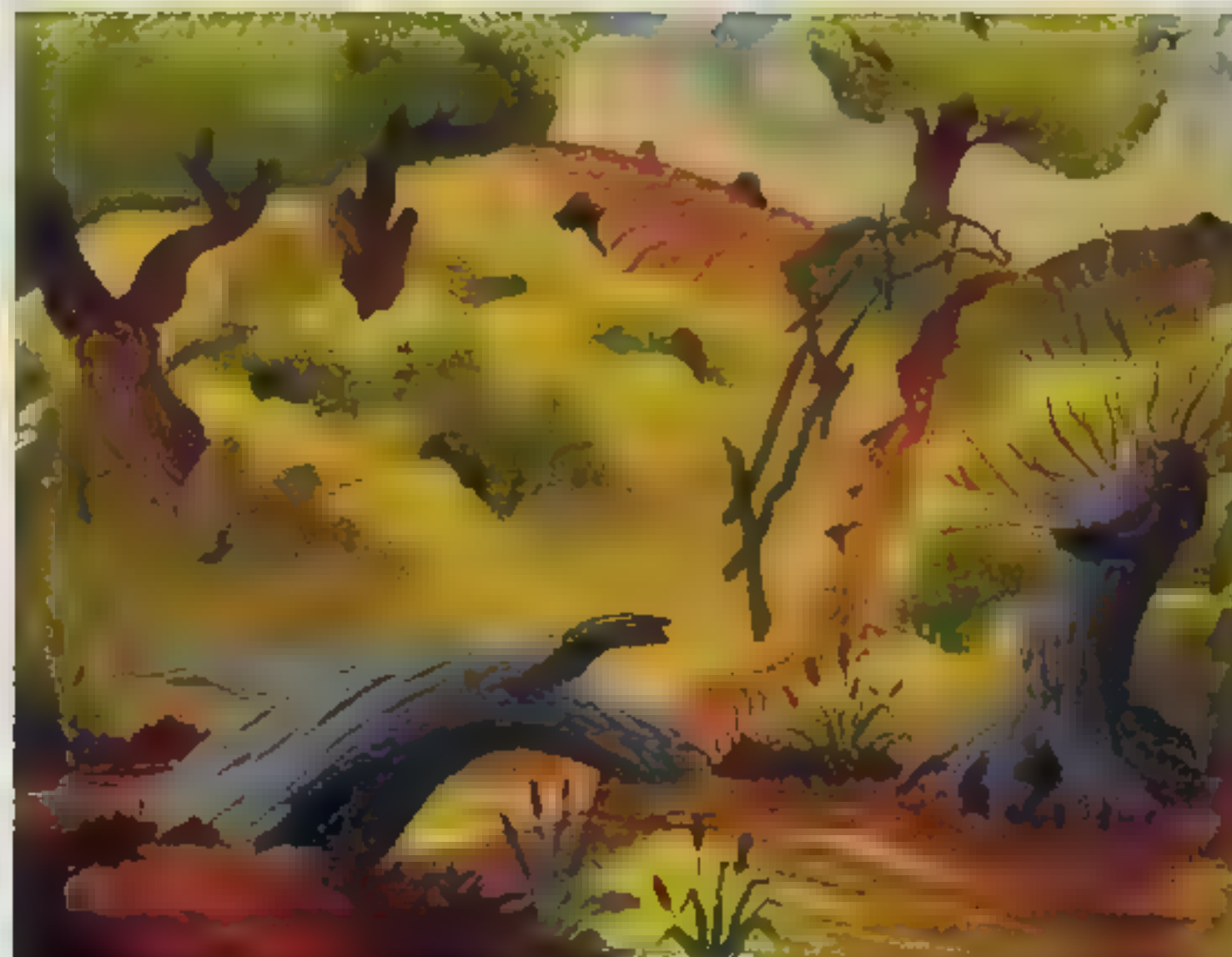
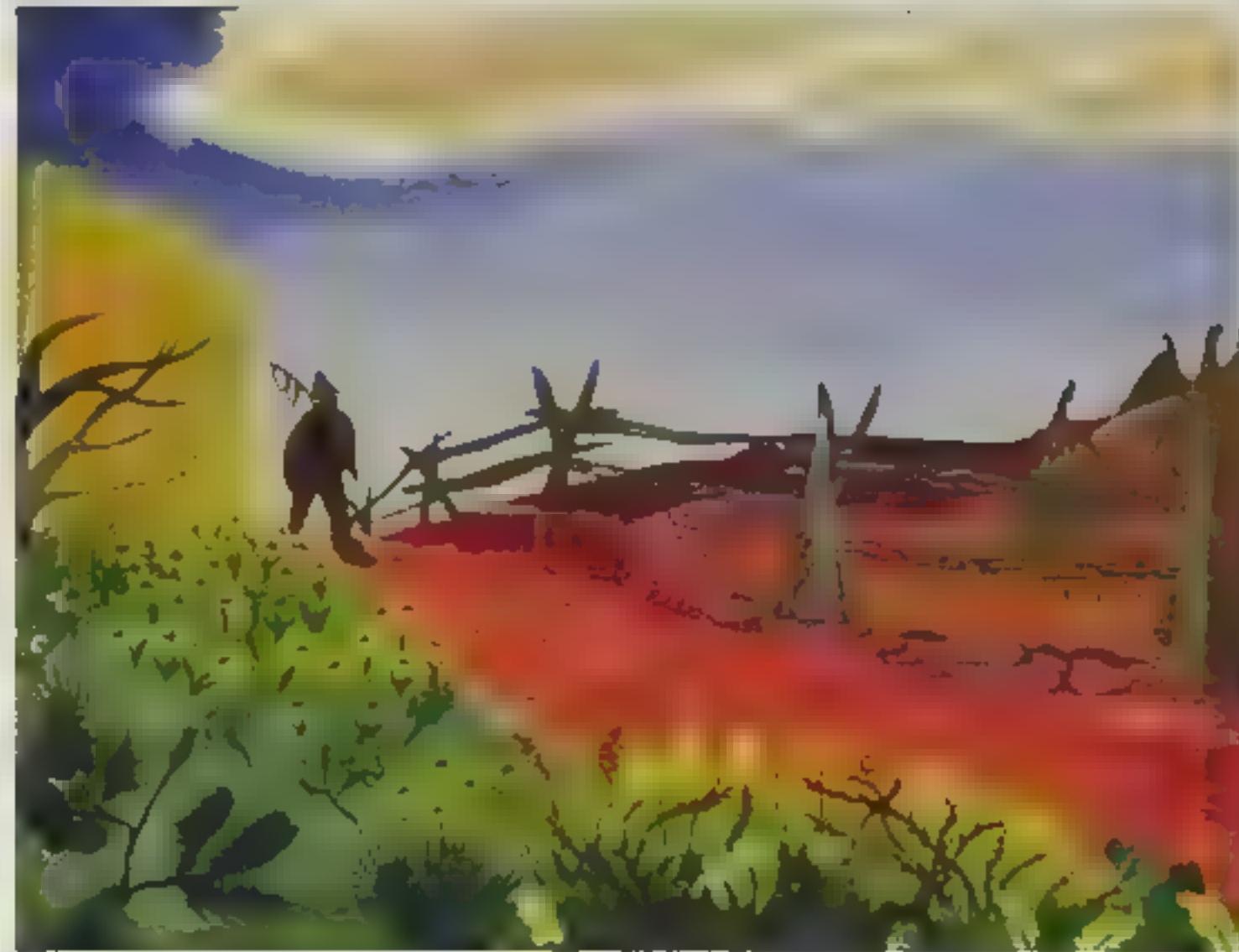
We'd make the short films to take to SIGGRAPH every year and I started out doing postproduction coordination and just general stuff, whatever had to be done. Then, when we got to *Tin Toy* I was the guy complaining the loudest about crappy computer graphics camera moves so John Lasseter looked at me and said, "All right, you do them!" It turned out I had a knack for the composition and the staging and the camera moves.

Tapping in to Unkrich's live-action experience helped Good and his young Layout team to develop an approach that matched established practice to an entirely new challenge:

It was a conscious decision on *Toy Story* to use very standard film or camera "grammar." I knew that the movie was going to look new and somewhat strange to the audience, so we thought, "Let's at least have them grounded in the kinds of shots they're used to seeing." So we did very few fancy camera moves. I had us model up cranes and tracks and things because one of my mantras is, "You move the camera because you should, not because you can."

OPPOSITE: While some of these Bill Peet story sketches feature a single character pose in close-up with only a suggestion of scenic detail and others show smaller figures against the full pattern of the landscape, each one provides suggestions about color in addition to composition and staging. In most contemporary animated productions, "colorscript" is handled independently of the storyboard itself.

Song of the South (1946)
Directed by Harve Foster and Wilfred Jackson



BELOW: Just as Bill Peet chose to explore the 3-dimensional space of the studio soundstage from the vantage point of the camera boom, Mary Blair's vivid color studies for the film present even the most fanciful, highly colored environments in realistic depth.

Color studies by Mary Blair
Song of the South (1946)
Directed by Harve Foster and Wilfred Jackson

In terms of visual storytelling there really is only one set of rules, but everyone has a different toolbox, a different way of getting there. But we're all using sequences of images in a frame to tell a story and so all the same principles apply. It's just a question of the grammar you're using. We are just like live-action except that our actors as well as our cameras are motion controlled.

Ultimately, the storytelling process in computer animation is governed not by the available technology but by the established principles of movie-making, as Unkrich reminds us:

People have been conditioned over decades and decades of watching movies. There's a fundamental film grammar that, even if they don't understand it, they know it like they know a language.

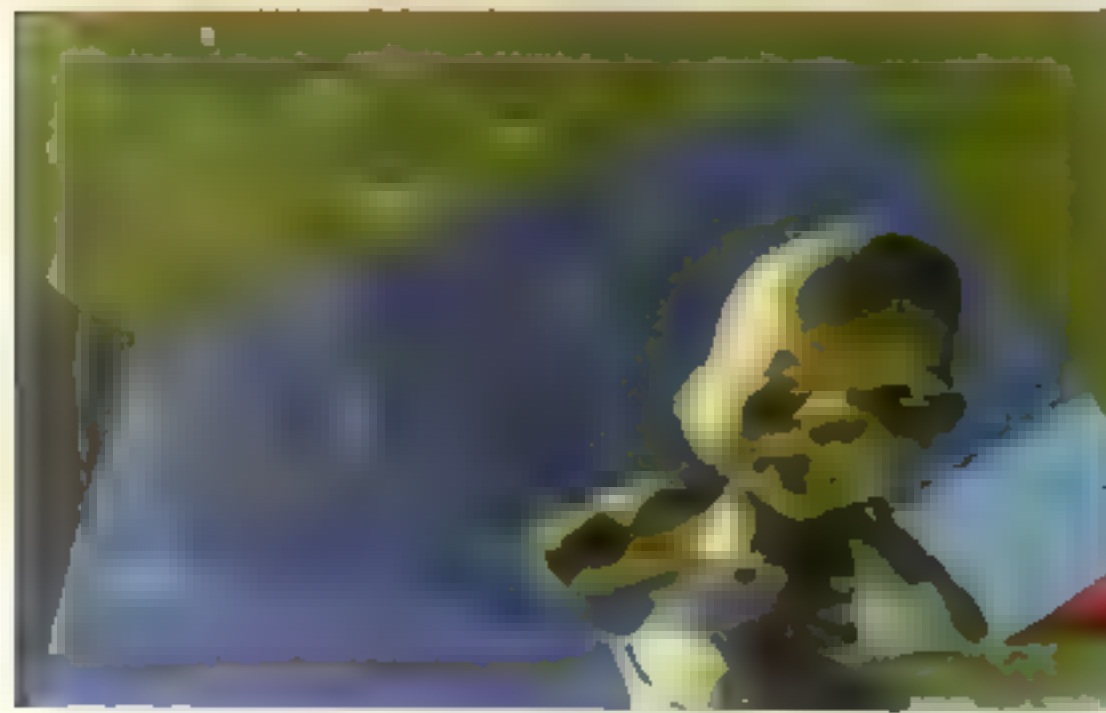
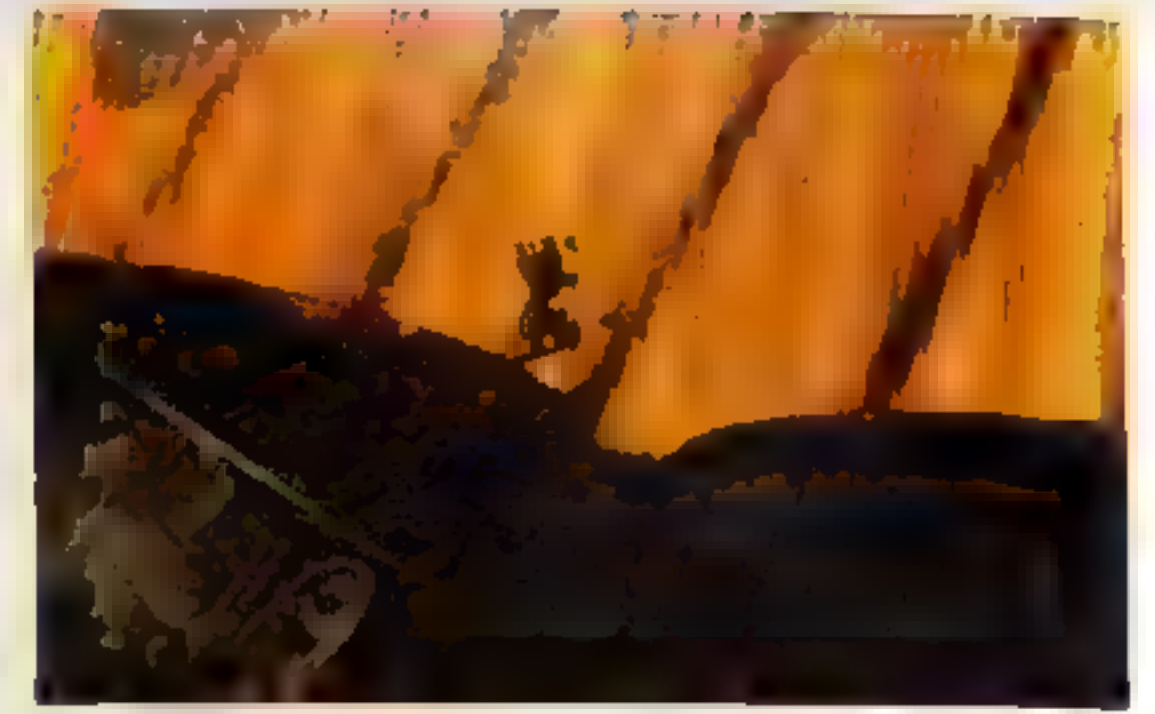
STEREO CINEMATOGRAPHY

Just as illustrators create single images that will be printed onto a flat page, the greater part of this popular-film grammar has, until recently, included the compression of 3-dimensional space into a 2-dimensional projected image.

Filmmakers can help an audience to identify with a child's point of view by bringing the camera lens down low, a simple technique taken even further in Pixar's Academy Award-winning *Tin Toy*, where we are shown the world from the even lower perspectives of a baby and a tiny clockwork one-man-band.

Tin Toy (1986)

Directed by John Lasseter



In everyday life our awareness of distance and depth derives partly from the ability of the lens in each eye to project a sharp image of an object (or plane of action) onto the retina, but also from our ability to fix focus on an object by aiming both eyes at it simultaneously. Because, in regular, non-stereo photography and cinematography the image is captured by a single lens, this latter part of the depth-perception process is missing.

Live-action stereo cinematography works by capturing movie images using two separate lenses and, in similar fashion, stereo cinematography can be achieved in CG animation by rendering each frame from two separate viewpoints. If the distance between these lenses or render viewpoints is approximate to the average distance between the human eyes, the resulting projected image, when viewed through the appropriate 3D spectacles, re-creates not only the arrangement of the different characters and objects within the flat x/y coordinates of the screen rectangle, it provides a realistic representation of the depth relationships between objects as they would be measured in the z axis. As Phil “Captain 3D” McNally, head of stereo cinematography at DreamWorks Animation, explains, some of the cinematic shorthand with which audiences have become familiar has to be considered anew by designers and animators working with the contemporary stereo toolkit:

In real life, if you’re looking at something close up, the background is out of focus, but it’s also double-imaged because we’re not *converging* on it.¹ With traditional filmmaking, of course, we don’t have the double image, so the blurriness on its own has become the cinematic representation of the combined effect of the double image and the blurriness that we see in real life. The blurriness has been amplified to overcome the lack of depth in the shot.

I tend to suggest that you don’t really need to use shallow focus for a stereo movie, and the reaction, typically, from people who’ve been into filmmaking a long time is, “But that’s filmmaking!” As much as it’s a successful technique in 2D filmmaking, you do have to step back every so often and go, “Well, hang on—why is it there? What’s it doing? Is it still valid?”

While it’s understandable that computer animation lends itself to the medium of stereoptical cinematography, based as it is on the mapping of coordinates within a digital simulation of 3-dimensional physical space, this doesn’t mean to say that one medium or technique has to be seen as conquering or superseding another. Each has its own particular design advantages, as Phil points out:

Even live-action is not that truthful an art form compared to traditional animation. Traditional animation is a truly 2-dimensional process—you design your shots in 2D, you lay it out in 2D, the production is all 2D, and the final display is 2D. I describe cinematography as “the art of 3D-to-2D conversion.” [It’s] the art of taking disorganized real life and converting it into a creatively controlled, 2-dimensional version. Traditional animation doesn’t have to do that because it starts as a 2D space and it evolves the ideas in that 2D space.

Live-action and CG are much more similar to one another in that, for the last hundred years of cinema (or thousands of years if you consider painting), as consumers as well as creators we’ve all become really good at converting 3D into 2D. We absorb [flat] images as a 2D experience and have our brains remap the space back into it.

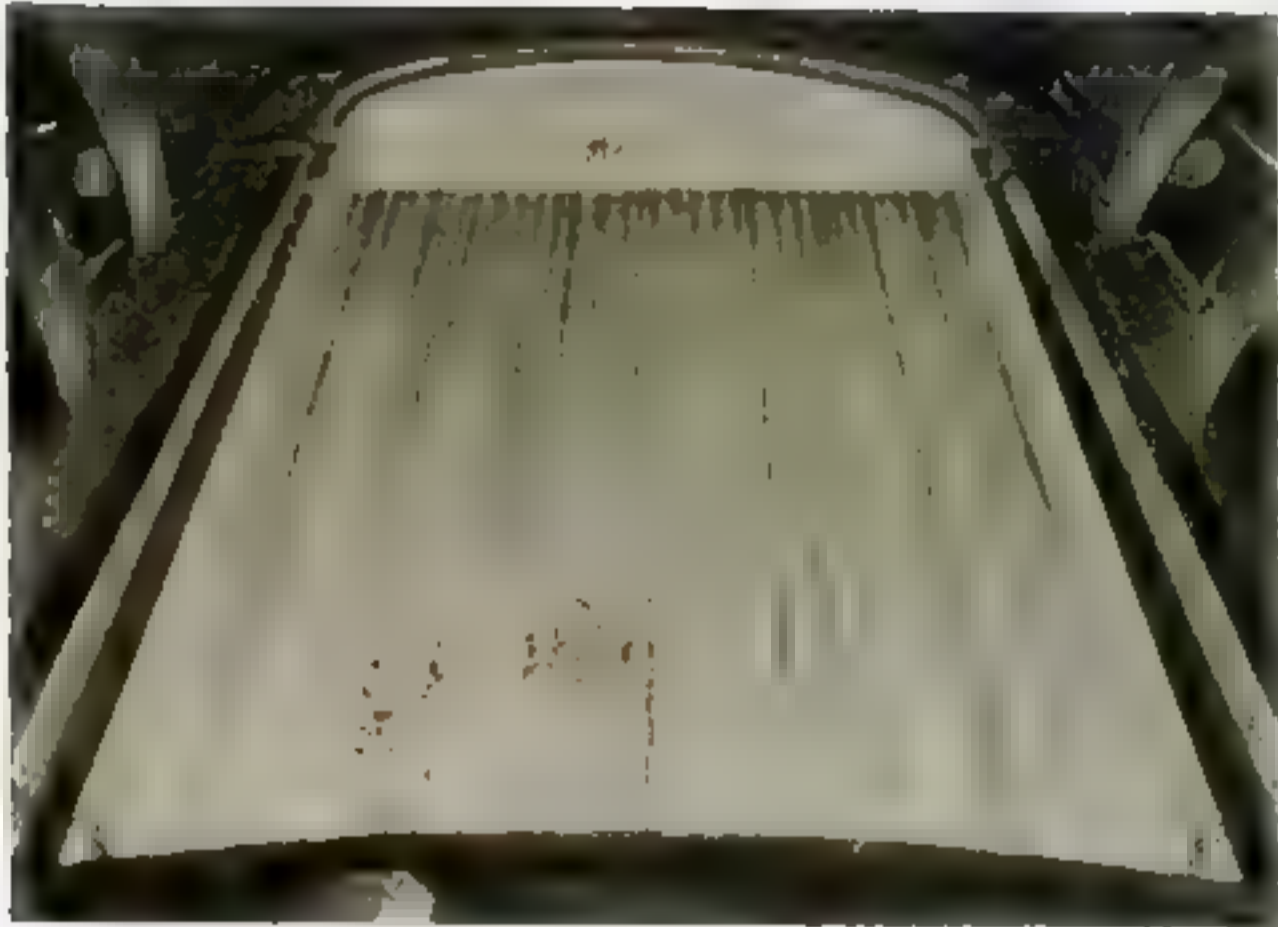
If we go from stories around the campfire to the written word to radio plays to movies and follow it

through color and sound, we’re really going more and more realistic all the time, and each phase has its own creative style: silent movies had orchestrated music that supported them, and they had their own particular visual style. We’re always evolving, and stereo is going to be another evolutionary development.

Having risen through the ranks of the Layout Department at DreamWorks Animation to a position as layout supervisor on *Shrek 2*, Bob Whitehill moved to Pixar at a time when the studio’s own digital production pipeline had evolved beyond the point where “layout” seemed an entirely appropriate term. The problem was eventually solved by rebranding part of Pixar’s Layout group into “Camera & Staging,” which, for anybody more accustomed to the terminology and procedures of the traditional animation process, perhaps provides a better fit with the actual division of labor in a digital studio.

In design terms, Whitehill, like Phil “Captain 3D” McNally, is eager to make sure that stereo cinematography functions as an integral story- and character-driven part of the moviemaking process. Using *Up* as an example, he gave a methodical, step-by-step breakdown of the production team’s approach to the question of depth photography as a means of further enhancing the film’s narrative:

On *Up* there was a visual structure imagined early on between squares and circles. If you look at the very shape of Carl, he looks square and angular, while the shape of Ellie and Russell is very round and soft, and the general idea behind those shapes is of a square feeling confined, rigid, or staid and circles being connected, adventurous, or emotional.



Patrick Lin [Director of Photography for Camera & Staging] went through and did a breakdown of what that would mean in terms of layout: squares would mean longer lenses, circles would mean wider lenses; squares would mean confining compositions where the ceiling, for instance, would be lower to the character's head than in a circle sequence where there would be a lot of headspace over the character.

We then went through, sequence by sequence, and said, "OK, this sequence where Carl has just lost Ellie; he's alone and his life feels very confined and trapped? Well then, that's a 'square' sequence," but when he's with Ellie or when he goes on the adventure at the end, those, of course, would be more circular sequences.

Patrick put together a graph between squares and circles as a guideline for the Camera & Staging crew about "How do we want to compose things? How do we want to block things? What lenses do we want to choose?" in terms of evoking this idea between squares and circles. And then I came along and I thought, "If I'm going to approach this movie in 3D (stereo vision), what does a square become in three dimensions? It becomes a



cube, and that cube can then be almost like a jail cell where the front of the cell is the screen and then the back is recessed into what we call 'stage' space."

It was impossible, when Whitehill said this, not to be struck by the similarity between this approach to designing a scene in stereo space and Don Bluth's description of what makes a layout convincing in traditional animation:

"That flat piece of paper you're drawing on should be considered a cube and not flat at all; you're carving something that goes dimensionally back into the paper. It's a dimension."

Stereo cinematography effectively provides yet another toolkit with which the space imagined by the animation designer can be experienced by an audience. Nearly a hundred years ago, Winsor McCay combined animated line drawings with his own carefully choreographed front-of-screen performance to help "dissolve" the physical flat screen and allow the audience's imagination to roam, with the animated characters, in the real physical space they knew to exist beyond the projected image.

Two different views of the same theater proscenium in which the lines of both architecture and drapery are deliberately stretched by the layout artist, much as a live-action cinematographer might select a particular lens to distort a real, physical interior for dramatic effect.

Original BG and character layout combined
(layout artist uncredited, possibly Tex Avery or Dick Bickenbach)
Scene 27, *Magical Maestro* (1952)
Directed by Tex Avery

As the stereo toolkit grows and develops, digital technology is effectively helping designers and audiences alike to discover the new story-specific possibilities of that same "theatrical" space. As Bob Whitehill went on to explain:

In the most extreme "square" sequences, Carl would be shoved backward, trapped within the "cell" of the screen, and he would never come out into "audience" space. A "circular" sequence would then become a sphere and that sphere would be placed halfway on the screen so it was halfway into "audience" space, halfway into "stage" space, and for the first time Carl could then grow out into the audience, [to whom he would] feel more rounded, more connected, more human.

While many of the 3D movies produced in the 1950s played primarily on the novelty of the technique, the visual grammar understood by contemporary audiences extends far beyond both television and advertising, into the more dimensional and immersive worlds of gaming and full-scale computer simulation. Phil "Captain 3D" McNally describes how comfortable younger audiences already feel with the technology:

We do an "Intro to Stereo." I take people into the theater and we start with an image that's flat and it slowly becomes more 3-dimensional. I've found that when I ask, "When does it start to hurt?" often it's the people with the most experience in filmmaking who get disturbed the quickest. But we had a Bring Your Kids to Work Day recently and, for that younger audience, it couldn't go 3D enough for them.

For Bob Whitehill and his team, designing scenes in stereo "space" means starting from the story

TOP Color, geometry, and the play of light across a simple interior combine in this poignant colorscript panel to reinforce the sense of claustrophobia and isolation felt by Carl Fredricksen following the death of his wife, Ellie, in Disney/Pixar's *Up*. Colorscrip panel by Lou Romano. *Up* (2009). Directed by Pete Docter and Bob Peterson.

BOTTOM While stereoscopic cinematography can be used to enhance the sense of depth and excitement in a fast-paced action sequence, it can also be used in more subtle ways to explore depth of feeling as in this example from one of the more "circular" sequences in Disney/Pixar's *Up* (2009) where Carl Fredricksen sets off optimistically in his flying house, only to find he has a stowaway on board. *Up* (2009). Directed by Pete Docter and Bob Peterson.

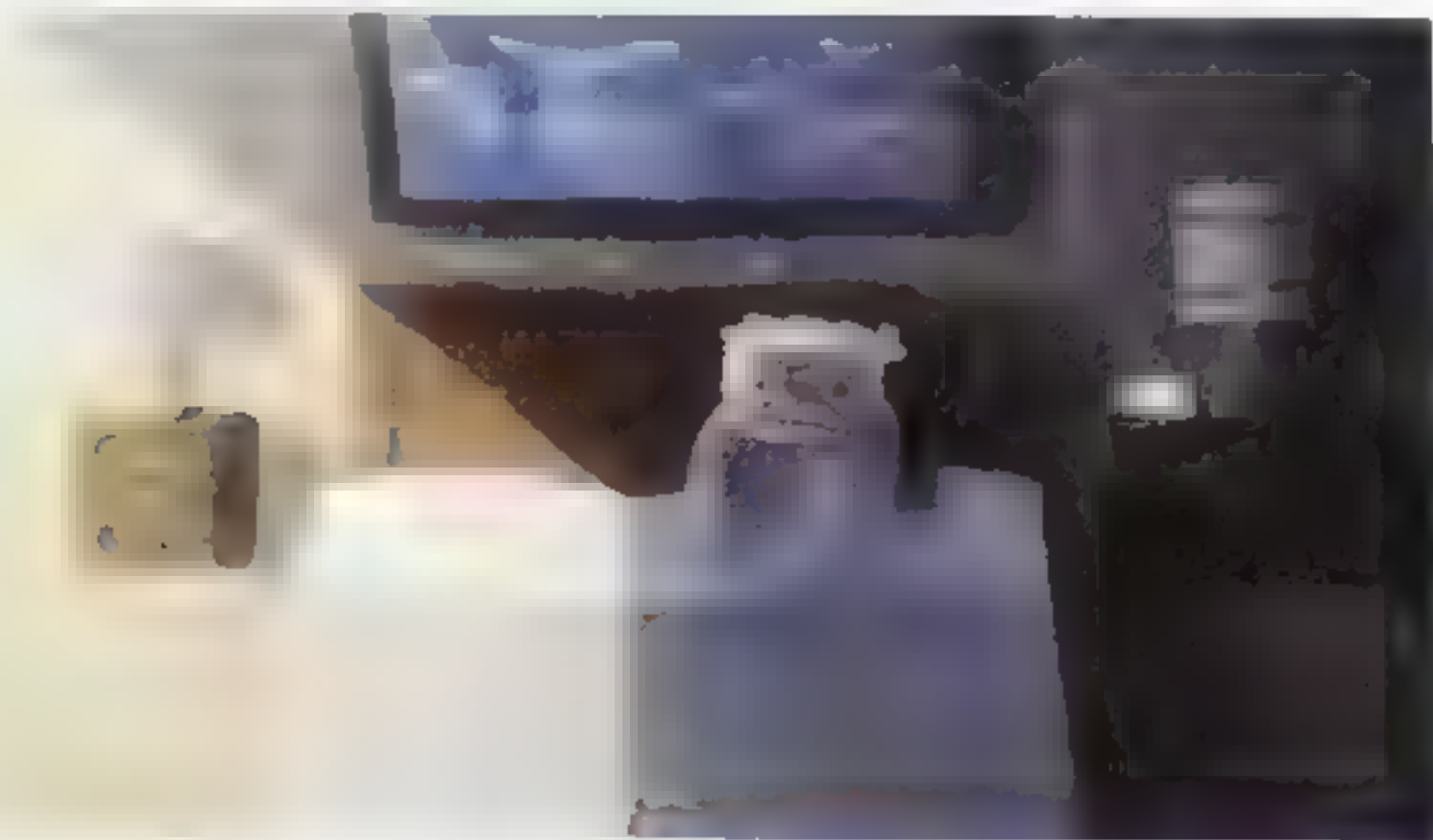
and working outward, just as it does for the art director or production designer exploring possibilities on other palettes:

If you look at the shot from *Finding Nemo* where Marlon and Coral are in front of the little anemone where they've laid their eggs, it's bright, it's beautiful, it's fantastic—but then when the barracuda comes you go to almost the exact same camera and it's dark, so it almost looks like a different movie.

If you notice how Radiator Springs looks when Lightning McQueen first arrives there in *Cars*, it's hot, it's desaturated, the long lens is collapsing the space, pulling in the mountains, pulling in the barbed wire behind him. If you compare that to the "Drive with Sally" sequence when he's grown to love this place, you have wider lenses, saturated colors, and so, to my mind, why in the world would you not use 3D in the same way as color and lighting? Have these extremes of contrast and use that?

By exploring the full range of dimensional possibilities in the digital sets they had built, James Williams and his crew also found powerful ways to emphasize the emotional state of one of their central characters:

Cloudy With a Chance of Meatballs is a film about a character who, in his mind, is living through a great disaster movie with all the type of camera work that that implies. In reality he's living at home with his father who wants him to work in a bait-and-tackle shop. So for those sequences we do a great number of proscenium shots to show his proscenium life and then the action sequences are very expressly choreographed, using certain lenses, certain angles to reflect his more 3D imagination.



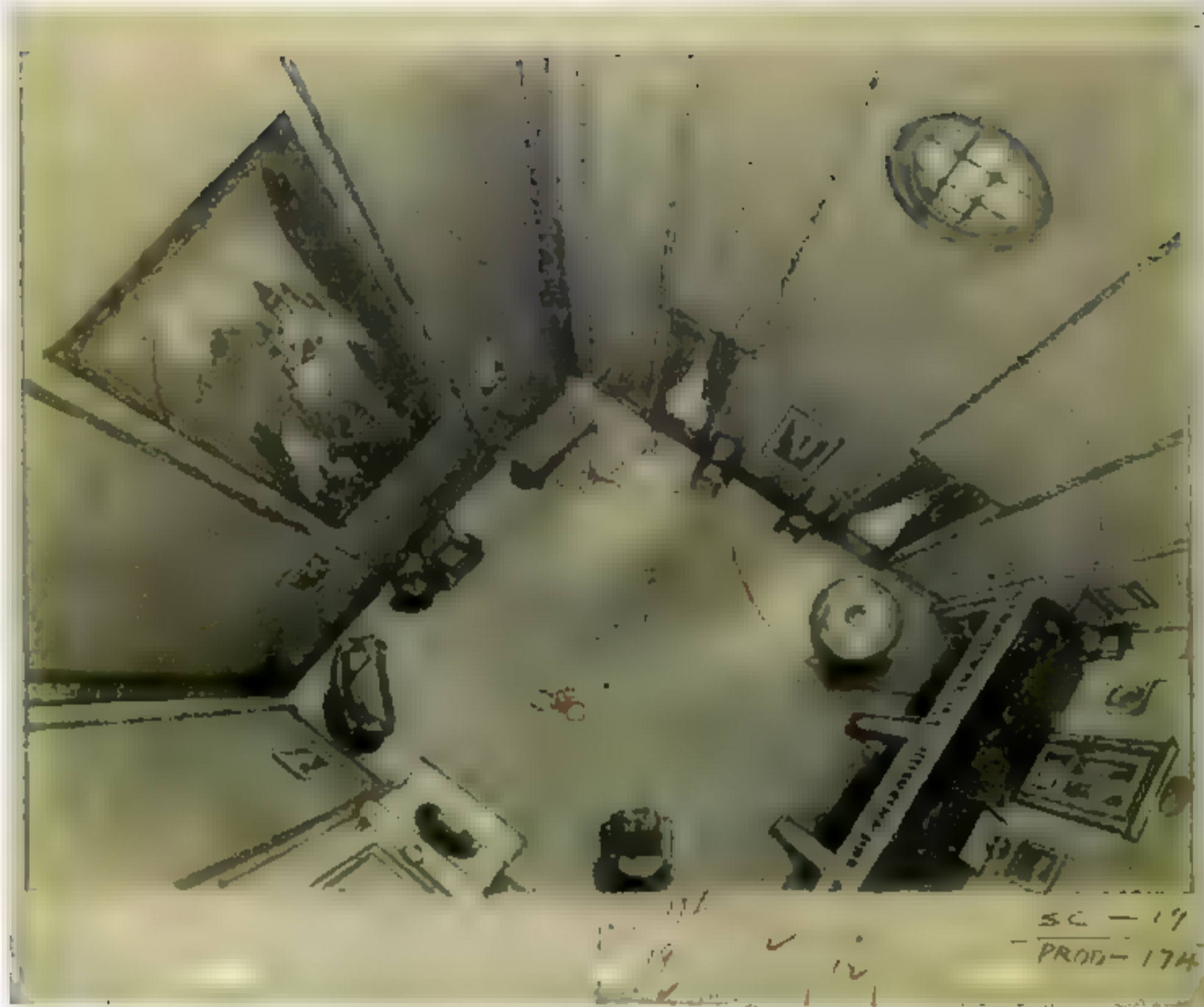
rice. "One of my goals has always been to create every single layout with something memorable in it (and) I've always looked for drama in lighting," recalls Ted Blackman, visual development artist on *Cloudy With a Chance of Meatballs*.

shown. By choosing a blue color scheme for Tim's Sardine Bait and Tackle and by darkening some of the surface detail, the movie's design team "lift" the storefront out of the yellowing mid-tone grays that dominate the surrounding buildings, streets, and skyscape.



Says Ted Blackman, "I used to sit in high school and draw telephone poles and people thought I was weird! I just think they're beautiful so I thought, 'This is the thing.' You're always looking for something that ties it all together."





Despite having lost one eye (and with it, any clear sense of depth perception), Tex Avery encouraged his layout artists to make use of striking and exaggerated pictorial perspectives in their staging of even the shortest scenes.

Original BG and character layout combined: tonal drawing of room interior with cat with dumbbell superimposed in outline (layout artist uncredited, possibly Tex Avery or Dick Bickenbach) Scene 19 *The Cuckoo Clock* (1950) MGM Cartoons Directed by Tex Avery

DEPTH PERCEPTION

Interestingly enough, among the surviving pencil background layouts from the MGM cartoon studios, the most radical pictorial perspectives are to be found in the shorts directed by Tex Avery, who tragically lost an eye in the early 1930s when one of the rubber-band fights that animators tended to stage from time to time got out of hand. It's difficult not to think of these exaggerated perspectives as a kind of compensation for the resulting lack of depth perception.

Even before the advent of modern stereo rendering, as computer simulations of 3-dimensional space became more and more a part of the animation design landscape, layout artist Drew Gentle, son of MGM background painter Bob Gentle, became increasingly grateful for the keen spatial awareness he seemed to have inherited from his father:

One of the things that really helped me in the last maybe ten years of my career was the fact that I have a very good spatial relationship/3D sense. So if you give me a drawing of a room I can put the camera on the other side of the room and show you what the reverse angle looks like; a lot of people can't seem to do that. I can also show you what it looks like looking down from overhead. And how much room there is, how much depth. So, since computer animation started coming in I've done an awful lot of work which I've been told is pretty damn accurate!

Contemporary filmmakers effectively have the entire history of visual, pictorial, and dramatic communication at their disposal but, while animation designers working before the advent of computers shared techniques and processes, as we've seen, with the traditions of other predigital narrative forms such as live-action, theater, and TV, CG layout artists now find themselves sharing

"A SPACE-CAPTURING DEVICE"

Expanding on the theme of lens choice as it affects the staging and visual continuity of a stereo computer-animated movie, Phil "Captain 3D" McNally made an important point regarding the power (or focal length) of the lens in a human eye and the resulting effect on our perception of the projected stereo image:

A 3D movie isn't something that you can walk around in; it's an illusion of 3D and it still ultimately is on a screen at the end of the room somewhere. But in terms of lenses and the angle of view that you would see looking at the world through a camera, when you sit in a theater, if you sit one screen-width back, which would put you in the middle of most theaters, the angle of view that you're looking to the screen is approximately 53 degrees. But in our (human) world that's a 24mm [wide-angle] lens; it doesn't matter what lens you use to create the shot, in a 3D movie it's going to be reformatted into that 24mm space because that's the viewing environment.

If you're cutting from a 24mm lens which fits very naturally into that stereoscopic space in the theater, then you would typically use a 50mm or even a 60 over-the-shoulder with a very shallow focus. What you've just done is captured a space; it's not a flat composition any more, it's a space-capturing device. So, with a longer lens you capture a space which is much more like a long hallway rather than a wide angle.

McNally went on to clarify the distinction between the illusions of depth rendered in traditional flat animation and the representations of 3-dimensional space in a stereo presentation:

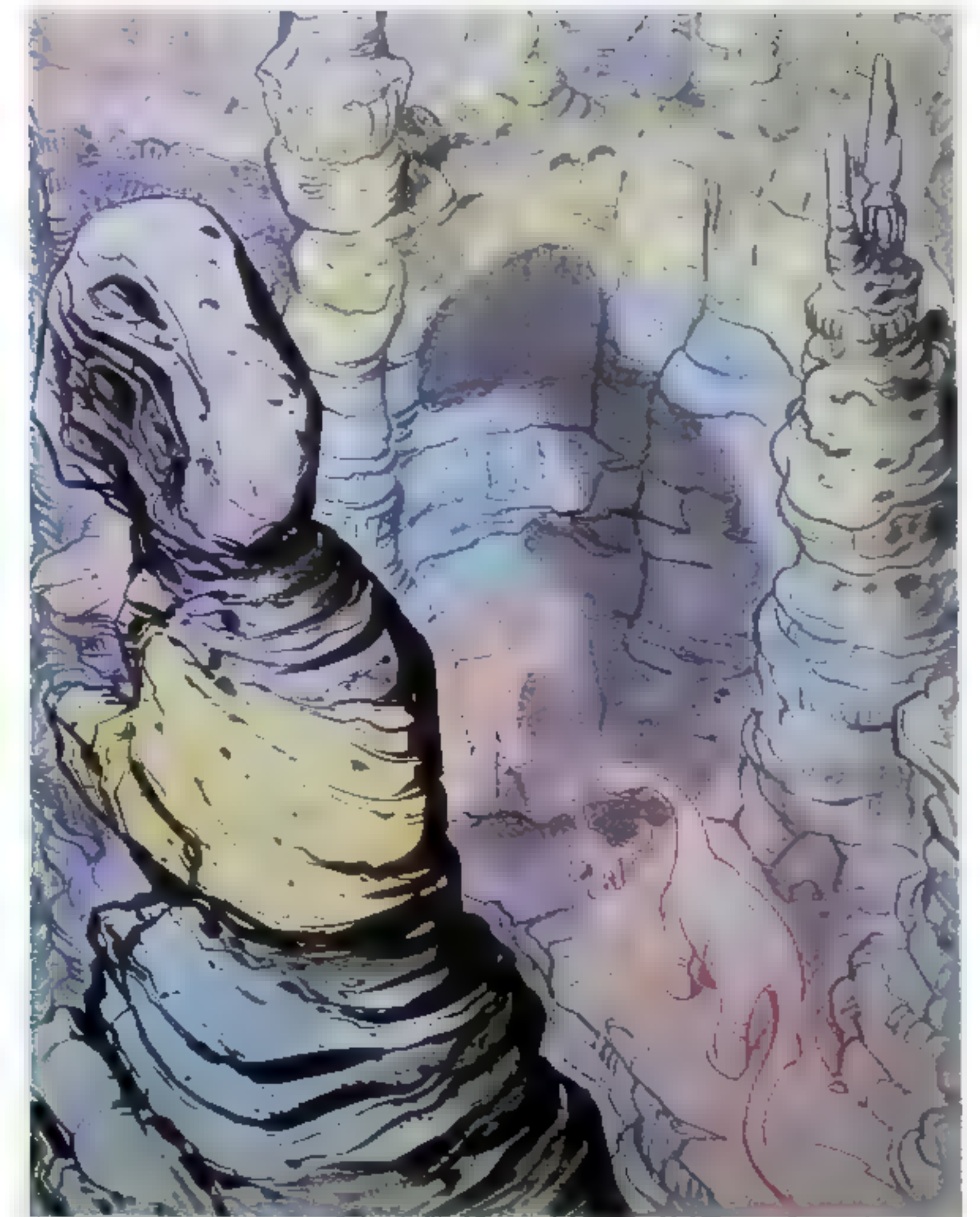
The difference between a 2D movie and a 3D movie is the actual presence of the illusion of depth in terms of something that is measurable. Literally, you could stick a tape measure out in front of the screen and measure how far something is reaching out or dropping behind whereas in hand-drawn animation what you can suggest with the illusion of depth is very unconstrained; you can draw it in many different ways and still get the illusion of space.

LEFT: Cleanup BG layout drawing (by Drew Gentle) with character key positions for Spike and Ducky indicated in red
The Land Before Time IX: Journey to Big Water (2002)
Directed by Charles Grosvenor



RIGHT: The keen spatial awareness that Drew Gentle inherited from his father (MGM background painter Robert Gentle) helped him to bring a dramatic sense of scale to this layout drawing in which the camera looks down on a rocky canyon deep enough to render even a dinosaur insignificant.

Cleanup BG layout drawing (by Drew Gentle) with character key positions in red
The Land Before Time: Invasion of the Tinysauruses (2004)
Directed by Charles Grosvenor



LEFT Working from original concept drawings and color artwork the digital modeling team can construct a three-dimensional virtual environment through which the digital characters and camera(s) can move freely.

TOP & BOTTOM Wireframe render showing the plotting of key camera positions for part of the "Lava Tubes" sequence in *Surf's Up* (2007).

MIDDLE Frame render from the virtual camera lens showing the characters' point of view as they slide down the lava tube.

Surf's Up (2007)

Directed by Ash Brannon and Chris Buck



RIGHT Powerful use of tonal contrast lends this development drawing a strong sense of scale and depth while the rock and lava formations help to create a "roller-coaster" perspective appropriate to the sequence.

Concept drawing by Marcelo Vignali for the Lava Tubes sequence
Surf's Up (2007)

Directed by Ash Brannon and Chris Buck

both a toolkit and a grammar with video games, an entertainment medium in which narrative is far more flexible.

One particular sequence on *Surf's Up* presented James Williams and his crew with a perfect opportunity to exploit game design principles in the construction and photography of the lava tubes buried below the surface of Pen Gu Island:

I was very lucky to have two artists on our team who were architects, accustomed to building environments for computer games. Building the geometry was very cheap because the environment only existed where the camera could see it, and beyond that there was nothing. The lava tubes were built by Layout because the camera itself determines what the action is.

There were a lot of designs proposed for the lava tube, and aesthetically they looked wonderful, but the designers had to realize that the tubes would never be shot from outside; the "roller coaster" itself was simply going to be a ride which the audience would go on. So we decided what the ride would feel like, built a motion path for that, and then built the environment around it. It was the antithesis of everything else in the movie, where, for instance, I could take you for a walk along Pen Gu Island and show you bowers and trees and things that never actually ended up being seen.

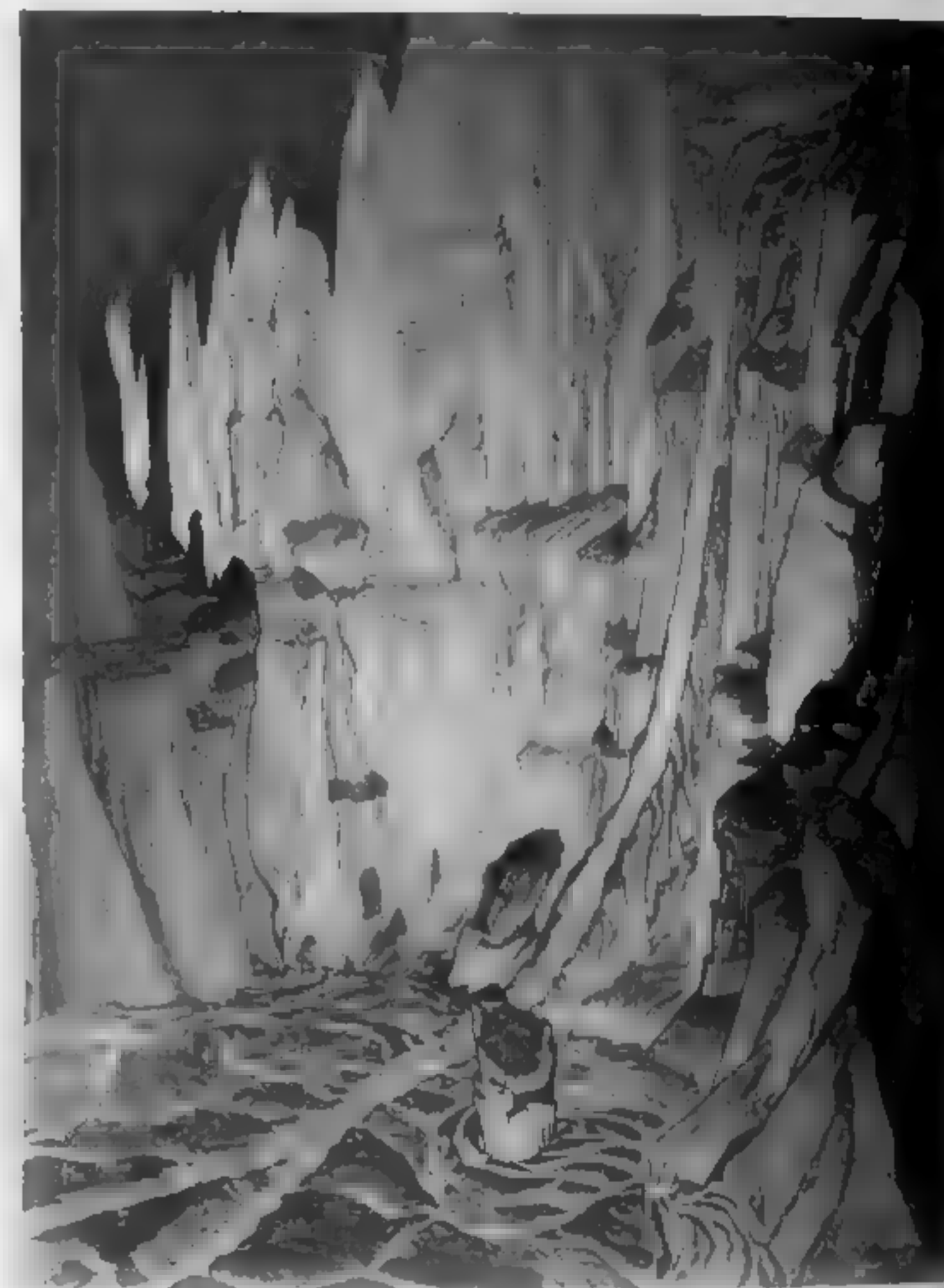
But there was a degree of efficiency in that as well, inasmuch as the environment could be built, textures and lighting could be applied, and then we'd simply "walk through" and shoot it.

While some filmmakers are still nervous about any overlap between CG animation cinematography and the camera language of interactive gaming, Lee Unkrich, like James, prefers to consider the possibilities it can offer:

OPPOSITE Color concept artwork by Marcelo Vignali for the "Lava Tubes" sequence.

Surf's Up (2007)

Directed by Ash Brannon and Chris Buck

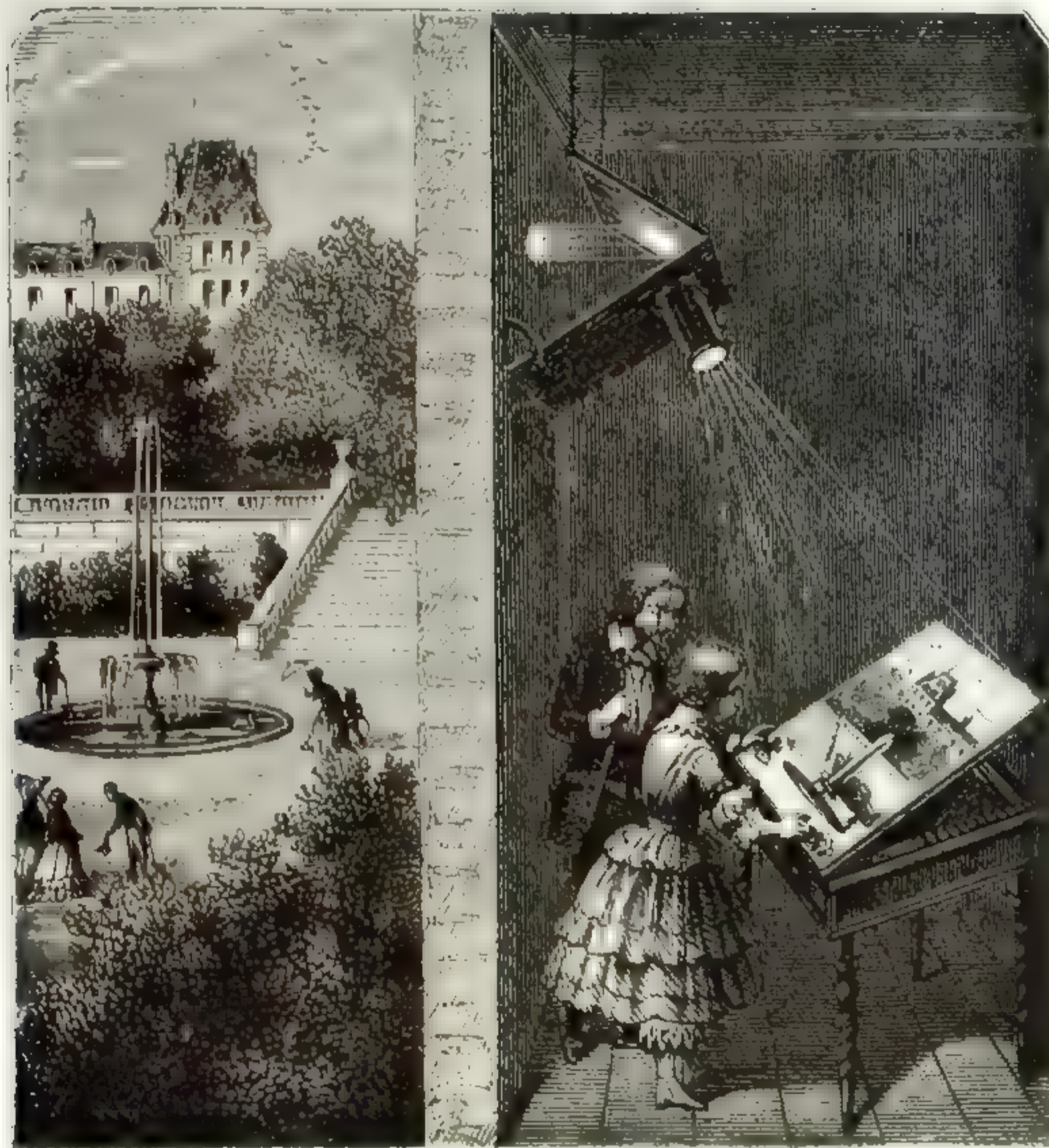


We are in a new era. Now that these tools are in the hands of kids a lot of young people are creating really amazing stuff. In a lot of games, the player is in control of the camera; they can fly the camera around to wherever they want, they can see what they want to see at any given moment. The games industry is now bigger than the motion picture industry and all kids are growing up playing these games, and that's their language, that's their vocabulary. As some of those people become filmmakers themselves that's going to feed into what they do. And what does that mean [for the future of cinema]?



LEFT: From the seventeenth century onward, the camera obscura helped artists turn projected images of the real world into painted pictures. By contrast, "camera capture" technology helps twenty-first-century movie makers turn flat sketches and concept paintings into "real" 3D worlds through which they can lead their audience.

Two children looking at a table camera obscura
Illustration from E. Atkinson's *Natural Philosophy* (1884)



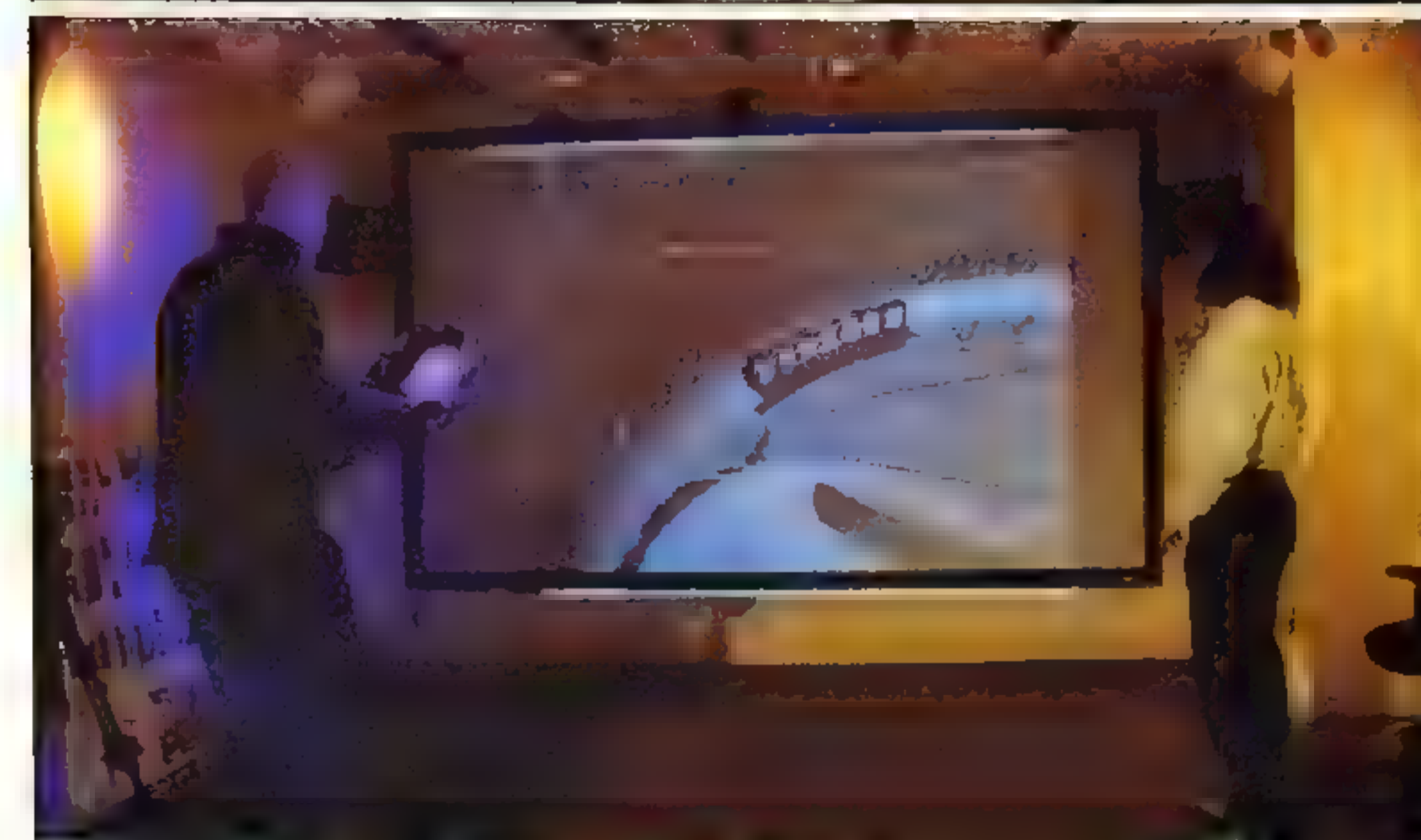
RIGHT: Exploration of virtual "locations" in 3 dimensions has become possible with the advent of various different "camera capture" technologies such as this one seen in use on DreamWorks Animation's *Monsters vs Aliens*.

TOP: Layout technical director, Grant Viklund (left) and head of layout, Damon O'Beirne (right)

MIDDLE: Damon O'Beirne

BOTTOM: Damon O'Beirne (left) and Phil "Captain 3D" McNally (Stereoscopic Supervisor)
Monsters vs Aliens (2009)

Directed by Rob Letterman & Conrad Vernon



Against the dramatic backdrop of a storm-ravaged night sky and the torn sails of a ruined windmill, an Undead Mage prepares to strike.

World of Warcraft, frame enlargement from Cinematic

ENVIRONMENT DESIGN AND CINEMATOGRAPHY FOR GAMES

“Animation is passive, level design is active.”

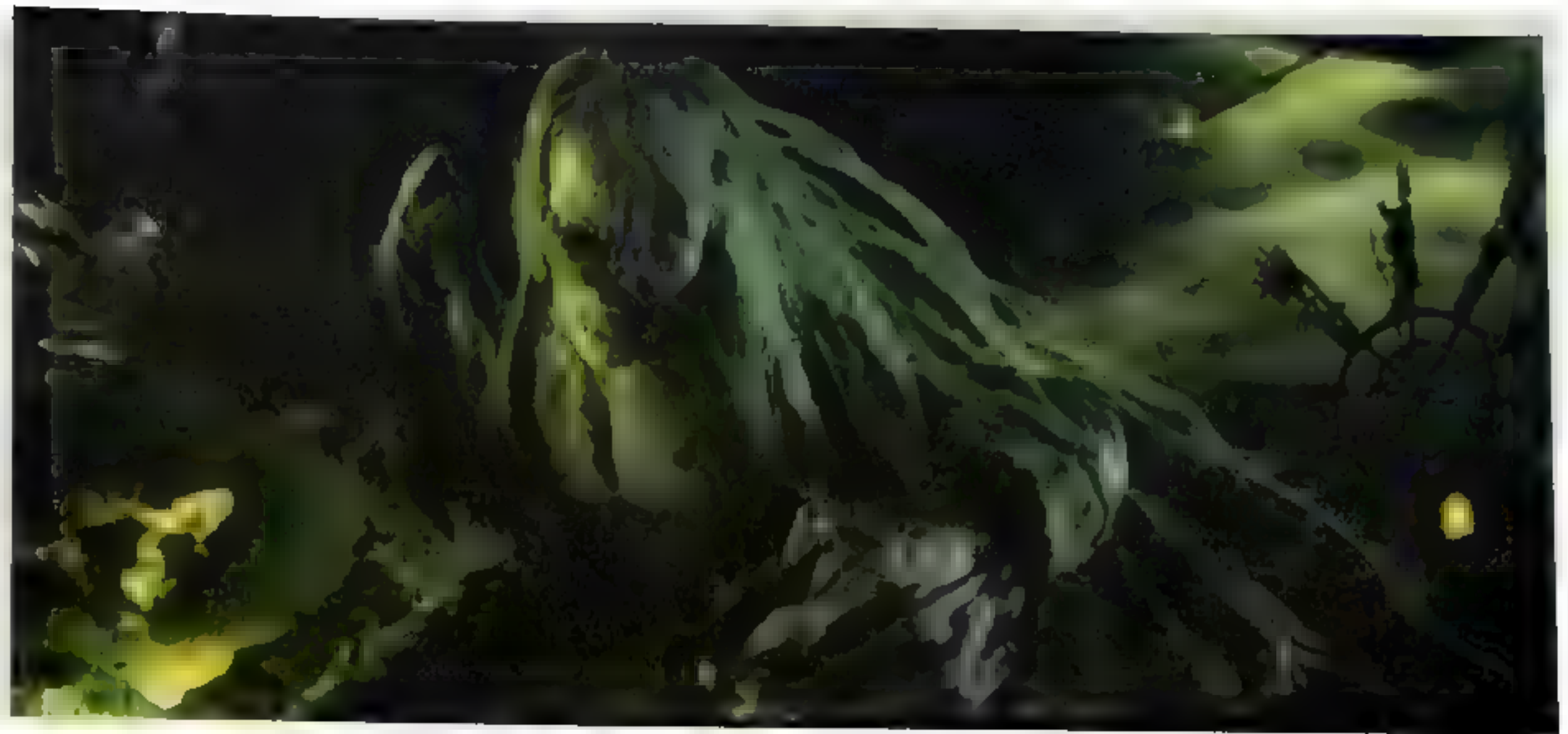
—Richard Leinfellner, chief executive, Babel Media

Animation artwork was first photographed commercially by rostrum cameras that had been designed to photograph artwork for reproduction in print. As Tom Baker made clear, this was still very much the practice up until the 1980s.

However, as we access more and more of our information and entertainment through personal computers connected to the Internet, our physical and our imaginative relationship to paper has changed. While our grandparents might have gazed at an illustration in a book and wondered what it might be like to climb into the page and explore that world, today even preschool children apply that same imaginative process to the world of moving images they see appearing on the many screens that surround them. Unlike movies, interactive games provide children and adults with the tools they need to enter and explore that luminous world.

I talked to Richard Leinfellner, CEO of Babel Media and one of the pioneers and founders of the games industry in the United Kingdom, about the new developments in layout design and camera work for CG movie animation. His reaction was immediate and positive:

There are lots of skills that a games person can learn from a movie person and vice versa. And I specifically like the idea of giving the director a “live” camera and saying, “There you go, what would you do with this?” Because that’s a lot closer to the player being in the scene.



In contrast to the movie industry, as Leinfellner went on to explain, design and animation for games has a quite different bias:

In a game, level design scores much higher than performance because, ultimately, performance becomes repetitive very quickly. Level design is actually the reason why you keep going. You don’t keep going because you want to meet the next character, unless it’s very deep RPG [role-playing gaming]. You keep going because you want to see the next level and see the challenges. So level design is huge. In fact, a game will fail mostly because of level design. People will normally put it down to bad gameplay and graphics when it’s really that the level design isn’t good. I would argue that the level designer’s got by far the toughest—and best—job, really.

While some movie purists might argue that interactive games pose a threat to both traditional linear narrative and the language of storytelling cinematography, Leinfellner prefers to acknowledge the merits and challenges of both media:

I think in cinema, ultimately you’re telling somebody else’s story, and it’s passive, which means you, as the director, control pacing, you control the information you share about characters, you control time. In a video game the player controls time. So at any point they can pause the game,

they can look around, they can slow the action down themselves.

You may want them to be in a really intense firefight but, unless you’ve crafted a level in such a way as to draw them forward, all you’re going to do is create a really frustrating experience, and they’ll get shot all the time. Similarly if you create a level where the player could just not be looking at the character he’s supposed to be looking at, the only way you can make them do that is to take the camera away, but then you get rid of the suspension of disbelief, the idea that *you* are really that character. So you’ve got to be really careful how you use those skills.

Leinfellner also appreciates how different the audience and player experiences are, particularly with regard to our perception of time:

If you watch somebody play *World of Warcraft* and you time it with three separate timers—time it in real time, time it as a spectator, and time it as the person doing the running and fighting monsters—I’ll bet you anything that the person fighting the monsters will be 30 percent faster in terms of their time elapsed, which will seem faster than real time; the person watching them play will be 30 percent slower than real time. That difference is experiencing it versus watching it.



That, to me, is a clear indicator that the actual processes that are going on in your head are very different, because time is very subjective. If you're waiting for a kettle to boil, it takes a long time. A good game actually is one you put down after six hours and go downstairs and put the TV on and realize it's three in the morning and time has just disappeared. That's a good game! But it's not a good movie. So—different skills.

"HAVE THIS IN THE BACK OF YOUR MIND; IMAGINE THIS!"

The important complementary relationship that exists between film and games is something that *World of Warcraft* itself has famously explored and developed in the elaborate "cinematics" or "cutscenes" produced, designed, and directed by the company's own in-house movie animation crew. Matt Samia, senior director for Cinematics at Blizzard Entertainment, explained their own production process:

What we have created here is a CG film studio, very much in line with DreamWorks Animation or Sony or Pixar or anyone else who's doing all-CG work. In *The World of Warcraft* game, you run around in this low-res, low-poly, low-detail representation of the environment so, while people can really become engrossed in the world, they never really have an opportunity to see it in all its potential glory. So our job is to expand the player's view of the world and really fill in the blanks.

Wrath of the Lich King is a great example. We showed an area of Northrend that you can actually get to, but in the game you never get a chance to see it in all its glory, except in the intro where we took a very high-res approach to really get people's imaginations working and say, "Have this in the back of your mind; imagine this!" and then, when people run around in that area in the game, they imagine it and it helps to flesh out their experience.





OPPOSITE, TOP: In the prevideo, predigital era, the beauty of an individual frame of cinema footage could only be appreciated in the form of a “lobby card” or photographic “still”; the stunning levels of detail achieved in game Cinematics can, by comparison, be fully appreciated simply by “freeze framing” on the screen of a laptop or home computer.

Wrath of the Lich King, frame enlargement from Cinematic

OPPOSITE, BOTTOM: Once the player’s imagination has been “primed” by the grandeur and detail of the prerendered Cinematics, the individual levels can be explored (and each interactive challenge can be met) in real time using lower-resolution graphics.

Gnome death knight fighting a Tauren shaman

TOP, RIGHT: This concept painting of an ice-bound Northrend landscape shows the influence, not only of twentieth-century movie design but also of nineteenth-century German romantic painters such as Caspar David Friedrich (1774–1840).

Production painting

Cinematics Project Lead Jeff Chamberlain outlined the importance of live-action reference to the Blizzard Cinematics design and animation crew:

As far as developing the final “look,” we tend to study something that has been filmed and use that as a reference for how deep the blacks are and how blown-out the whites get, decide what exposure we want to aim for. Then we’ll do what we call a “production painting,” a piece of digital artwork which tells the compositing team how the lighting should be, and then it’s the artists’ job to translate that into artwork. That artwork is then used as the “legend” for all the other shots.

The Blizzard team, echoing Ken O’Connor’s “purse strings” approach to layout, also pays close attention to production costs in all aspects of the design and rendering of their environments and, as Samia explains, narrative is of prime importance too:

Our approach tends to be more of the effects approach than a virtual-set approach, for a few reasons: one is that the high degree of realism we shoot for means that if we modeled every piece of everything in a huge landscape, or even a set like a room, then moved the camera around in there, it’s really cool to have that freedom, but it’s hugely expensive and time-consuming. We might spend time on stuff that’s never on camera anyway, so we’ve taken more of the effects-studio approach where we only build what the camera sees, shot by shot.

Wrath of the Lich King is a good example: we’re doing set building and modeling the environment that the characters are interacting with on anything that’s close, but beyond that we’ll do a lot of low-poly modeling and project onto that.

We’re also very much involved in pushing the stories forward, involving the player in the

LEFT Though movie action figures and "tie-in" character merchandise have existed for as long as movies themselves have been made and marketed, interactive computer gaming has reintroduced—and expanded upon—the potential, once enjoyed by children in the days of the Victorian toy and puppet theaters, for players to decide how a character will move around and "perform" within a stage set or an imagined environment.

Fairy "Sackgirl" costume designed by Francis Pang
LittleBigPlanet™



backstory or the ongoing story of the game. A lot of that happens in the movies; certainly that's the real showcase for it, the point where the game stops. When it pauses, hopefully the players get really involved in what's going on and they meet these characters and they find out what's going on in the story of the game and the story of these characters because we present it all cinematically as a film, a movie.

Interestingly enough, while many artists working in CG feature animation have an almost exclusively live-action frame of reference, Matt Samia is a keen admirer of layout and background design from the "Golden Era" of the early Disney features. Some years ago he jumped at the chance to see firsthand how some of the original artwork had been created:

I personally love vintage Disney. I think *Pinocchio* is one of the greatest films ever made. An old friend of mine who worked at the Disney ARL invited me over and said, "Hey! You want to see? We found some new stuff." And I remember he

RIGHT In the *LittleBigPlanet* world of character design and animation, gamers have a wide range of "digital puppetry" controls at their fingertips, giving them control over everything from the movement of the limbs to the facial expressions of the figures.

Hard Hat "Sackboy" character designed by Francis Pang
LittleBigPlanet™

opened up some of the drawers that they have there and they had some of the original glass plates from the multiplane shots. They had a plate from the opening sequence going into Geppetto's workshop, and I looked at it and of course I knew exactly what it was! And I just said, "Oh my God! Can I touch that?"

A THROWBACK TO PRECINEMATIC CONVENTIONS

As my own first exposure to set design came from cutting out and coloring in the miniature paper scenery supplied with the cardboard Pollock's Toy Theater when I was a kid, I was interested to find that the *LittleBigPlanet* design team at Media Molecule in the United Kingdom had been using the CG toolkit to create interactive environments that were deliberately, even defiantly similar to the "flat" simplicity of Victorian parlor toys. As Senior Artist Shaun Elstob explained:

Unlike a lot of games which are, in very real terms, 3D environments where you can go backwards and forwards and up and down, we think of our game almost in terms of a theater where you have the empty stage and you actually build a set on that stage. Then you've got your characters interacting with the set you've built and playing with each other so, it's almost a throwback to precinematic conventions.

Character artist Francis Pang took the idea even further, emphasizing, as Richard Leinfellner had done, the importance of leaving room for the audience's own imagination to engage:

I think theater can often be more powerful than film, because it's the *indication* the set designers are providing rather than the full thing. I think when you move into a certain amount of literalness you do definitely lose a bit of mystique.



Lead level designer Kengo Kurimoto explained the game's "junk shop" aesthetic:

It's a creative tool that people can use to build their own worlds and then, once they've built them, they can share them in an online community where they come together and play together over the Internet. The main focus of the game was to make creativity accessible to the user.

We wanted to present the visuals in a way which wasn't either alien or too "tech-y" to people. That was where the idea came from to use all kinds of "craft" materials. We wanted them to look really good obviously, but we also wanted them to look slightly rubbishy as well in a hand-built kind of a way. So that was the main premise of the aesthetic for *LittleBigPlanet*. Trying to make it very low-tech within a high-tech framework.

The thing which I found really interesting about it was that it almost seems like we've gone full circle back to things like theater design.

The childhood pleasure of finding a "secret" corner in which to create an imaginary world from found objects and discarded odds and ends is brought vividly to life by the introduction of a warm pool of light to this otherwise darkened interior, mimicking the play of a child's flashlight beam.

Photograph by *Robert R. Taylor*
www.roberttaylor.com



TOP LEFT Theater, film, and games ideas overlap as scenic "flats" share space with a camera and movie lighting apparatus in this rough sketch for Media Molecule's *LittleBigPlanet*.

Preliminary concept sketch by Kareem Ettouney
LittleBigPlanet™



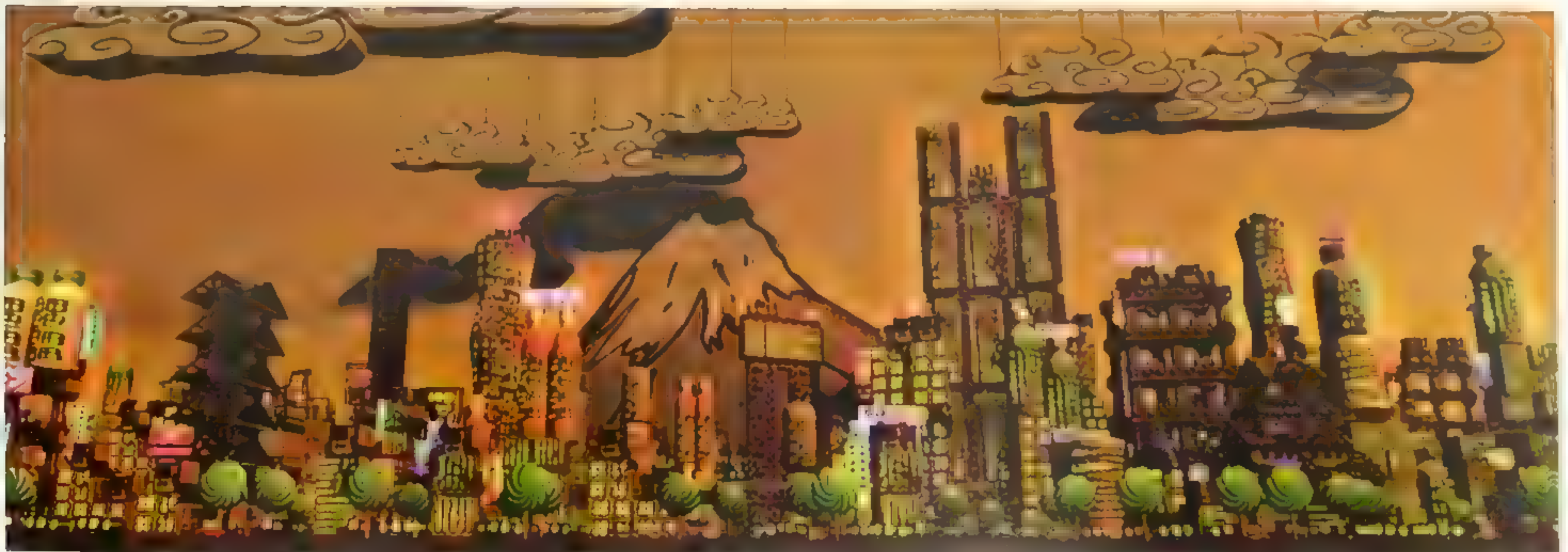
TOP RIGHT With some elements suspended on strings and others moving along on tiny wheels, this sketchbook page explores the theme of inventive play based on the kind of "make-do" games that a junk box full of assorted random objects might inspire.

Preliminary design sketch by Rex Crowle for Mexican-style gameplay motifs
LittleBigPlanet™



TOP: The cutout cardboard shapes, paper flowers, and stitched felt that have been arranged in a frieze between the picket fence and the brick border in this level design may be "virtual" but the flexibility of the digital "raw materials" and the gaming toolkit opens up all manner of possibilities not available on a tabletop or bedroom floor. "Red Riding Hood" level design by Shaun Elstob
LittleBigPlanet™

BOTTOM: The same digital toolkits that are used to produce complex photorealistic fantasy landscapes for computer games can also be used, as in this example, to create a deliberately "homespun" look in which the imperfections are part of the appeal. Experimental level design by Kengo Kurimoto
LittleBigPlanet™



"Grand evening rehearsal of *The Miller and His Men* and terrific explosion in the housekeeper's room": a nineteenth-century teenager fires a starting pistol to add dramatic impact to a toy theater presentation, thereby proving that contemporary concern about the portrayal of violence and destruction in popular culture is nothing new.

Illustration by John Leech from a series of etchings entitled "The Young Troublesome—or Master Jacky's Holidays" (1845)

Alongside customization of the environment in *LittleBigPlanet*, lighting and character performance are in the hands of the user, too, all of which makes an interesting departure from the notions of "control" that have tended to dominate animation design for movies and TV. Francis Pang, originally trained in hand-drawn animation, has been amazed and delighted at how *LittleBigPlanet* users have managed to exploit this latter freedom in particular:

The players have direct control of the character's arms and his mood so that allows them to "act" with the control pad. It's quite insane, because being a traditional animator, I think about stuff like anticipation and character motivation, "Why is he doing that?" But that goes completely out of the window when you allow a player to do whatever they want.

"THE ESSENCE OF THE STAGE"

Whatever screen we position ourselves in front of and whatever aspect ratio or entertainment format we compose, design, and choreograph for, the conventions of theater set design continue to be relevant and important because they provide the foundations upon which all subsequent forms of dramatic narrative performance have been built. With this in mind, I couldn't help being struck by one of John Leatherbarrow's many recollections of the sometimes eccentric but always inspirational approach Richard Williams took to exploring what was possible in the medium of traditional animation:

When I first got involved in *The Thief and the Cobbler*, Dick Williams took me into the camera room and he pointed at the camera and said, "That's your stage!" And I thought, "What?!" I thought, "Well, that's one of the most extraordinary things



to say!" But now I understand fully what he was saying. It was true! You have to light it and you have to make it look good and you have to think of your audience.

Speaking in an interview with Michael Barrier in 1973, veteran cartoon director Hugh Harman gave a clear indication of the productive manner in which traditions from one performance medium can influence and enrich design practice in another. In spite of being nominated for an Academy Award in 1939 for his MGM short *Peace on Earth*, Harman clearly felt that his own awareness of theatrical design traditions had developed too late in life:

It seems we wasted so many years, and this goes for Rudy [Ising], it goes for Disney; I would say it goes for all of us, if we analyze it. We had to learn the craft the slow way. If any of us had in the beginning, as Orson Welles had, the essence of the stage and motion picture mastered, then on top of that learned the craft of animation, we could have made worthy things.

Whatever Harman might have meant by "worthy things" and however much we might disagree with his downbeat assessment of his own and others' achievements in traditional animation, we need, as director, layout artist, and animator Don Bluth explains, to recognize and explore the overlap that exists between the two design traditions:

TOP & MIDDLE RIGHT. Working in the 3-dimensional "virtual" realm has, oddly enough, introduced many traditional animators to some of the techniques and features of stop-frame animation, the wireframe character models having the "feel" of a puppet or a mannequin.

Monsters vs Aliens (2009)

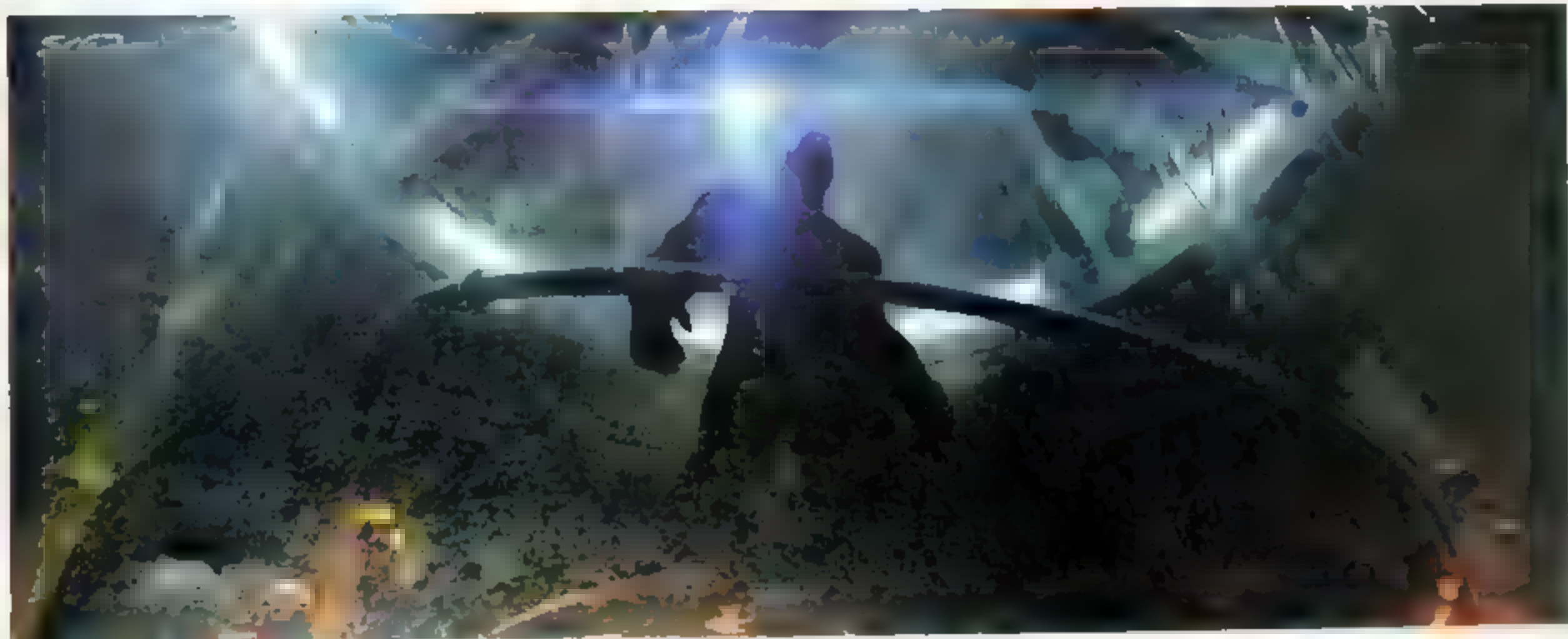
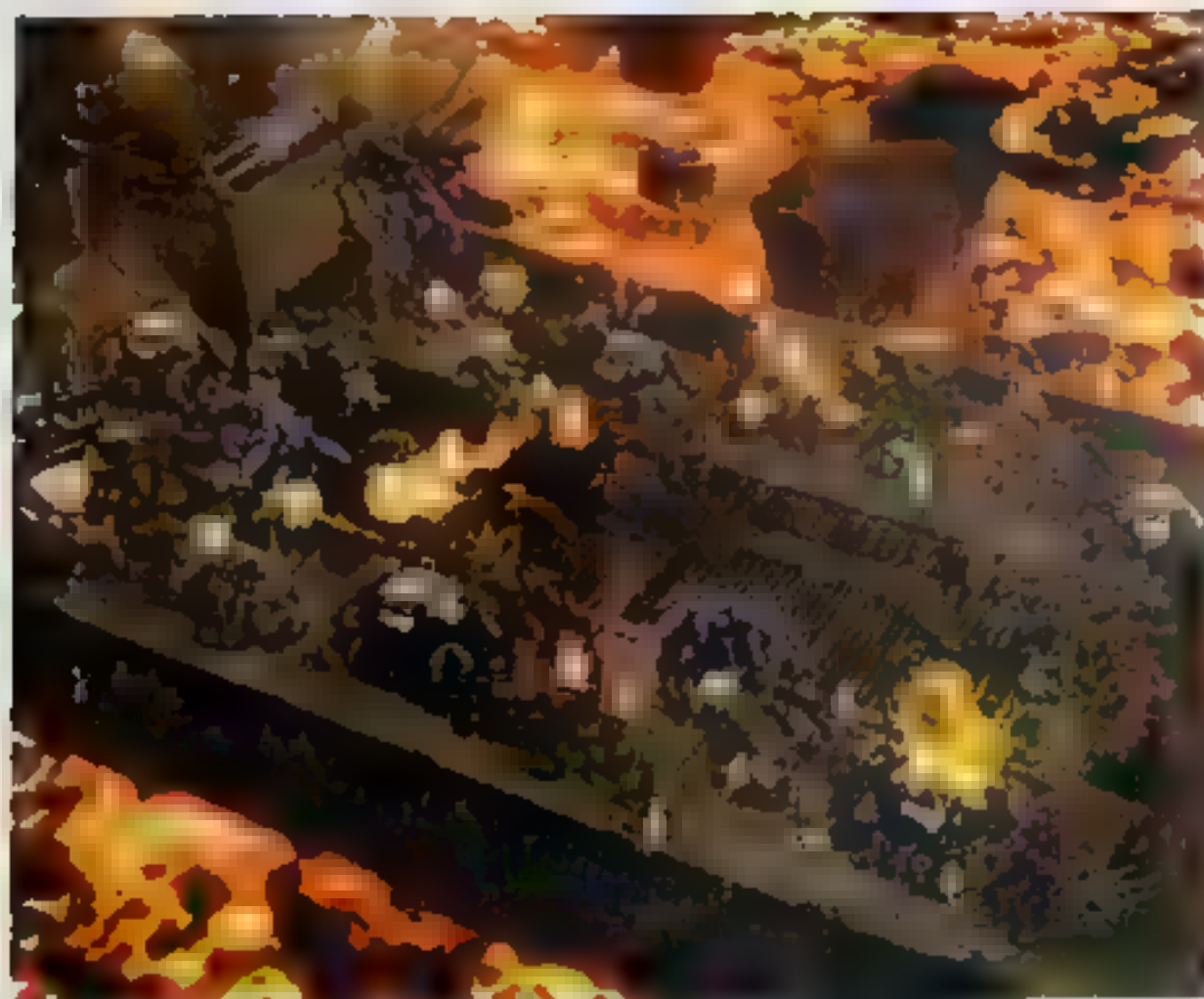
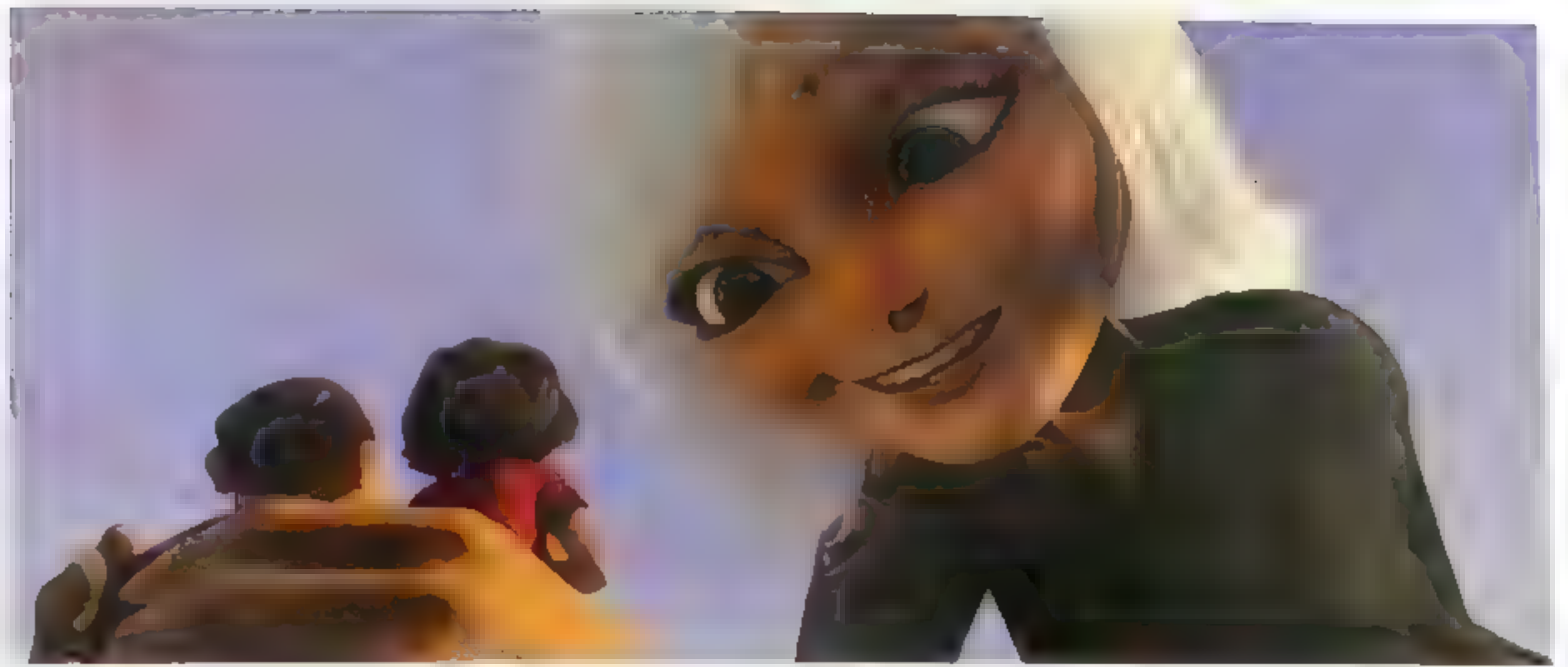
Directed by Rob Letterman & Conrad Vernon

BOTTOM, RIGHT. Game Cinematics (sometimes also known as full motion videos or cut scenes) provide spectacular high-resolution movie-style narrative and action sequences that enhance and explain the dramatic premise and character histories to the gamer.

Preproduction artwork for *Star Craft II*

BOTTOM, LEFT. Even at the lower resolution required for real-time gameplay, ground shadows, explosions, and other special effects can now be included, lending extraordinary realism to the gaming experience.

Star Craft II, New Folsom



Within the proscenium arch you're actually layering it, you have the wings and you have backdrops and you have the moving sets, the things that fly up and the things that fly offstage right and left. All of this is the mechanics of creating the environment and we do the same thing in the old term "scene planning," where we planned how the camera would move.

Furthermore, though it seemed possible at one point that CG might trample traditional animation underfoot, the two not only coexist, they complement one another in important ways and they share an expanding moving-image market not only with games but also with stop-frame animation, and even with much older forms of miniature theater, as Bluth went on to describe:

The difference I draw between classical and CG animation is that classical animation was very concerned with the drawing, the look of it, the design of it, and what the character thought and how it acted. I believe that the animators in CG are more like puppeteers. They take an existing model that has been built, maybe even by another department, and then they move it around.

When David Burgess, a traditional animator who leapt at the chance to move into CG work in the 1990s, spoke about the digital character animation he now does at DreamWorks Animation, I was struck to find that he too chose to describe digital animation in exactly those terms, partly to "personalize" the hi-tech process:

I think of them as digital puppets, rather than just a bunch of pixels. I suppose in terms of the model, because we're seeing it in a 3D space and you can spin it around, it just feels like a mannequin or a puppet of some kind.

NEW WAYS OF STORYTELLING

For Pixar designer and illustrator Lou Romano, the tighter boundaries within which a designer has to operate in "old school" scenic design can be both helpful and productive for an artist working in CG:

I do love theater design because it's another way to think about design in a certain limitation. Giving yourself the parameter of the proscenium. I also really appreciate the fact that, with a limited space, you're challenged to create changes simply with lighting and simple set pieces because of that limitation. And I think part of that influences what I do. Obviously in CG there aren't those limitations, but it's still nice to try to create some.

Though also influenced strongly by the notion of working creatively within the established limitations of the movie medium, Lee Unkrich sees all manner of possibilities in the responses of younger artists to the emerging technologies:

I think the rules and the history are very important, but I also try to keep a completely open mind to new ways of storytelling that we haven't figured out yet. I'm always open to seeing something new and interesting, even if it's not rooted in the history of what we've done. I think there are plenty of opportunities and reasons to break those rules—if you break them for the right reason: if it's the story that you're telling and the effect that you're trying to achieve.

Because it both stimulates and feeds off the human imagination, storytelling has never been passive. It has always been interactive just as carved, painted, and drawn images have always "moved," though they may appear static at first. The word "animation" is commonly associated with the idea of movement when, in a very real sense, it is actually all about the movement of ideas.

So what, in view of all that we've seen and explored, do we mean by "layout"?

Movie, television, and game animation stimulates important interaction between the real world and the world of our imagination, between past and future experience, just as all preceding forms of pictorial and narrative art have done across the centuries. The art and techniques of animation layout have developed (and still are developing) in response to the human need to see and react to stories in context, whether that context be naturalistic or fantastic.

The more I thought about the various different rigs that have been used to expand the possibilities of layout design on movies such as *Surf's Up*, *WALL·E*, and *Monsters vs. Aliens*, the more I realized that, in addition to its obvious overlap with gaming technology and live-action location scouting, it reminded me most clearly of the very device that first inspired artists to "draw with light": the camera obscura.

By capturing a moving daylight image of the outside world with a lens and then projecting it onto the wall of a darkened room, painters like Vermeer could then fix the image by hand. But in doing so the image naturally "froze." Used in its modern form, this same technique allows layout artists to project whatever scenic images they can see in their own imaginations onto any one of the screen formats through which we currently share moving, storytelling images. And within those imagined worlds, all manner of characters and stories can come to life.

Four views of a detailed 1:6 scale model of the room in which the seventeenth century Dutch artist Johannes Vermeer staged many of the scenes that he painted (in this case *The Music Lesson* circa 1662-1664)





OPPOSITE, LEFT: Ray Aragon at his desk in the Disney Layout Department, late 1950s.

OPPOSITE, BOTTOM: Ray Aragon's home studio, Woodland Hills.

OPPOSITE, RIGHT: Color sketch, unknown magazine. Advertisement (1950s)

"YOU ARE A CAMERA": RAY ARAGON ON LEARNING AND TEACHING ANIMATION LAYOUT

Of all the many interviewees I was lucky enough to meet, one person in particular lit up the picture, partly because of his unique knowledge and expertise in the field of animation layout, but even more so because of the sheer joy and exuberance with which, at the age of eighty-three, he was happy to relive so many moments from the varied career he had clearly enjoyed so much. Ray Aragon didn't just talk, he enthused. And he didn't just describe things, he brought them vividly to life. Opening the door to a room littered with sketch books from every decade since the 1940s, Ray grinned like an inventor about to unveil a time machine:

Here's where I work!

He opened each sketchbook with a description of the city, sometimes even the specific neighborhood or restaurant he'd been in when the pages filled up with his amazing pen-and-wash snapshots of passersby and his riotous descriptive ink lines. On the first page of one of the sketchbooks there was a street corner I thought I recognized. Then, in the corner of the next page, beneath four drawings of a woman standing and sitting in different poses, some drawn from life, others referring back to wartime sketches made twenty years previously, Ray had written, "Recuerdas de Londres."² Ever the detective, I asked, "Is this in London?":

Oh, we were there for many, many months, my family and I. I worked on *Yellow Submarine*. We were in Soho Square, on the east side. I love London! My friends, the city! The city! [thumps table] Paris I don't like.

"But London you do?"

Oh, I love London! I love to draw old-fashioned stuff.

Another book opened up; there were people chatting on a sidewalk:

This one goes back to the '80s. I was sitting at the counter in Nick's Restaurant. That was located on Vine Street in Hollywood. I'd go and eat there, and I would look out the window from the counter. I like to draw from people. I do impressions, sketches of what I see. I'm not a cartoonist, as you can see. I'm really more of a real-life proportion guy. I take my sketchbooks out to the malls, anywhere I'm at . . .

Traveling from page to page, soaking up all the beautiful artwork, I asked Ray about his artistic training and his own arrival in the animation industry. He grinned broadly at the thought of it all:

I studied to be an illustrator and I was in the advertising business for about two or three years, but I hated it. So I went back to Chouinard at night to brush up. It was one of the greatest schools of all time! Oh, my God?! Marc Davis was teaching there at night and I told him what I was doing. He realized I wasn't happy so he gave me a number and said, "Call Ken Peterson," and I said, "Marc, I can't draw Mickey Mouse! I can't draw Donald Duck!" but Marc said "Never mind!"

So I called Ken, and Disney's hired me and put me in the Layout Department on *Sleeping Beauty* and I began to learn the mechanics of it, the field moves and so on. Marc Davis brought me over to Disney's and that got me into another world!

TOP: Hand studies, sketchbook page.
Ray Aragon

BOTTOM: Ink study of a group of soldiers, November 1952.
Ray Aragon



TOP Different costumes, different years, similar poses.

Figure sketches, ink, memories of London.

Dates: 1944, 1967, and 1982

Ray Aragon

Artwork photographed by Michael McClure

Half a century on, Ray was still aglow with the pleasure of working in this unique environment, particularly the chance it had given him to learn about all the different skills involved in the animation production process. But the one ability he admired most in any artist surfaced again and again, throughout everything he described or recalled, to the point where it almost became a kind of punctuation:

My God, these guys could *draw!*

The character animators in particular had Ray's respect from the beginning:

We were on the second floor. And we had big rooms! Big desks, big chairs, and all the storyboards. The animators had small little tiny rooms, but that's all they needed, just a room and a desk. I would go and visit Marc on the animation floor, say hello and he'd say, "Hey, Ray, look! Let me show you what's happening here," and he would flip the drawings of the crow on the shoulder of the witch in *Sleeping Beauty* and say, "This is called 'overlapping action,' Ray." What the hell did I know about it? He would flip them and I could see how [the witch] would say something and as she turns the crow does this overlapping move. And it worked!! And I said, "My God! He can tell me what the characters are going to do—and then he shows me!"

I was amazed. I learned so much from the animators. I'm not an animator, but I learned that in moving these things they do this, they do that. And the drawings are not static. Yeah, those animators at Disney's were unbelievably good! Marc Davis, Milt Kahl... My God, these guys could draw. They could *draw!*

BOTTOM Figure sketched from Nick's Restaurant, Vine Street, Hollywood.

Figure sketches, ink and wash, October 1982

Ray Aragon

I asked Ray about the different artists from whom he'd learned his layout skills. Once again the names came up, one by one, followed by praise for their draftsmanship:

I worked under Don Griffith on several productions and Tom Codrick, too. Working around and under Ken Anderson? That man could draw! You should see his storyboards from *Jungle Book*. The composition by guys like Don DaGradi, Tom Oreb's model sheets. And Bill Peet?! My God! Those guys, all of them, could draw!

I got this room for myself to storyboard for Winston Hibler, he was a producer. I had this huge room! And you know, the director or whoever would come into your room and talk to you or maybe they would come in, wander around at noon, and all your work is on the wall.

In the '50s I would walk from room to room during lunchtime. I'd see composition by guys like Don DaGradi. Everywhere I look! They were good, all of them! Tom Oreb's model sheets and his drawings from *Sleeping Beauty*? These horses, these people marching?

We became friends. What a guy! Ray Patterson was another wonderful kindly man. I would say to myself, "This is artists' heaven! I'm in heaven!" And I watched the guys like Bill Peet and I learned about storyboard. You learn! You learn.

I was interested to know what Ray believed to be the priorities in layout design and Ray was only too happy to describe his own approach, firmly rooted in what he himself had been fortunate enough to learn in the company of so many other talented artists:





OPPOSITE AND BELOW: Observational watercolor sketches (development artwork).

Ray Aragon

The Iron Giant (1999)

Directed by Brad Bird



When I say “layout,” forget the mechanics of old-fashioned layout! Forget the mechanics; I mean *composition*. Set it up! Stage it! That is layout! It came from the Masters, and that’s applied to anything. A lot of students don’t know composition. And you have to know composition. If you can’t compose, forget it!

At Disney’s I would do little roughs and then I would show them to Don Griffith and whoever else might pass and of course the roughs have all the “guts.” So, it’s all called composition, it’s all called continuity, it’s all called learning from the guys at Disney’s! Bill Peet? The continuity! The cuts! The flow! The staging!

They set it up for the animator and they changed it according to the animator’s wishes. If it doesn’t work? Change it! So, I learned that—because I did that over and over and over . . .

Many years after working at Disney, Ray was given the job of passing on some of his own learning and experience to the students at his alma mater, which had developed into CalArts,³ still perhaps the biggest single feeder college for the major American animation studios. Pixar’s Ralph Eggleston remembers Ray’s drawing classes very clearly:

We had Ray as a life-drawing teacher at CalArts and, wow! That was fascinating. Ray Aragon’s a man with classic experience. He draws like an SOB; he has lots of great thoughts about framing and not just about framing characters. That’s become a shorthand way just to make things clear. Ray’s just a brilliant designer. I certainly learned a lot. I just wish to God I’d been able to take his layout class because right when I left is when he began teaching layout.

However, not all of the students who had the chance to take Ray’s classes saw the appeal or understood the importance of layout, as he himself recalled:

I taught layout at CalArts, but they were primarily animation students studying under Hal Ambro and they were not really very interested in layout. They were interested in animation. They were thrown into my class for layout and they were bored. They wanted to learn animation!

There was the shortest of pauses and then, with a shrug, he added:

Can’t blame them!

MEXICO VERSUS THE KITCHEN TABLE

For Ray, drawing was much more than a mere mark-making process. The things that mattered were observation and the direct, personal angle that observation allows each artist to take on the world around them. He had no patience with the notion of squandering ability and time on anything received or secondhand, nor did the choice of, say, exotic subject matter for its own sake impress him:

I tell students, “If you’re drawing from a photograph, you can’t see around! So you copy what you see and it’s flat. But when you draw from something that’s real, you can see around it! See how the thing is made!” I say to people, “Draw what’s around you!”

One guy that I knew went to Mexico to try and improve his painting. He said, “I’m going to come back with some wonderful watercolors from Taxco! So quaint.” But I said to myself, “He thinks he’s going to go to Taxco and come back with some beautiful Mexican juicy compositions? But he’s

TOP, LEFT AND RIGHT Ink and watercolor sketches of a haunted mansion interior (1977)

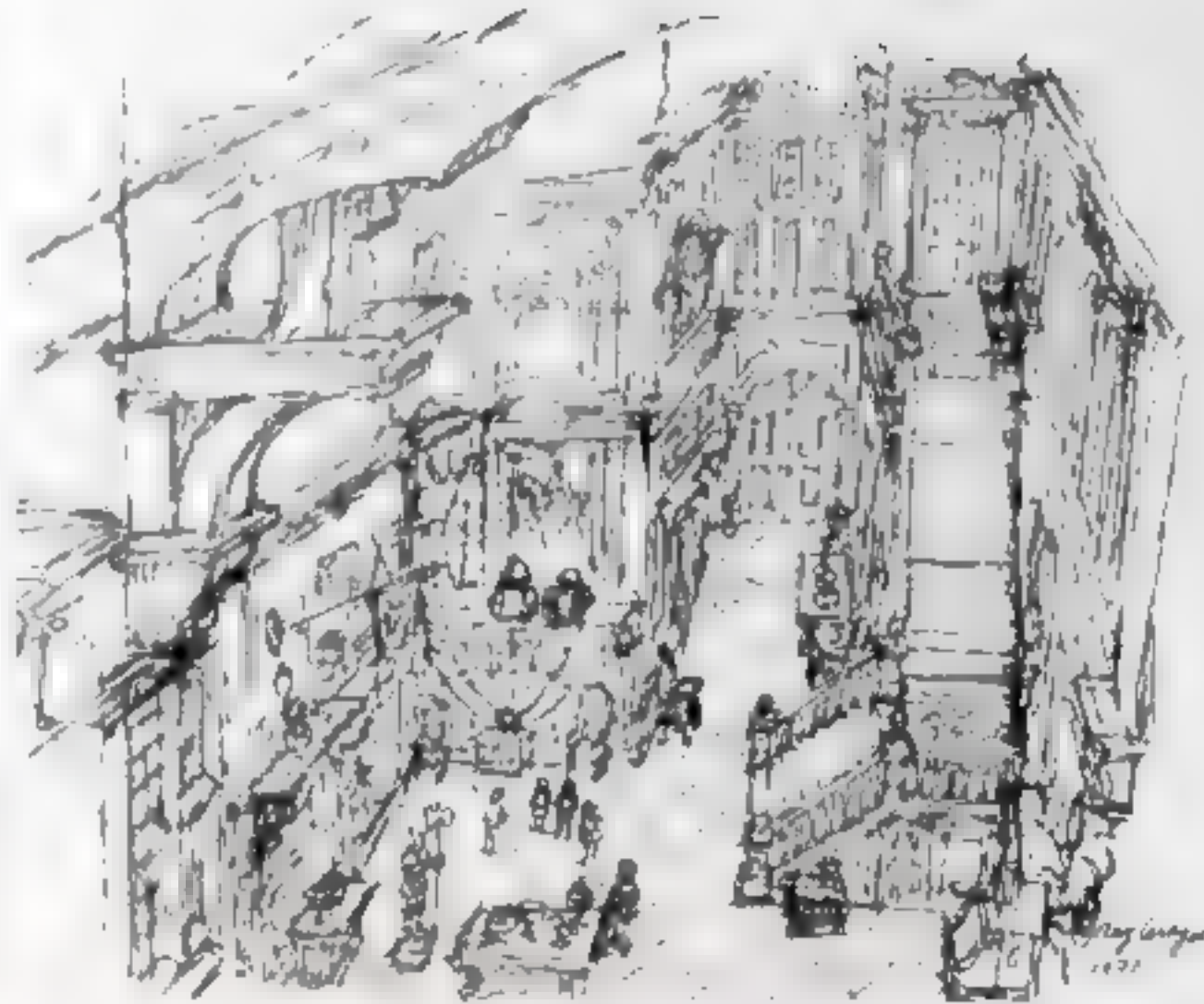
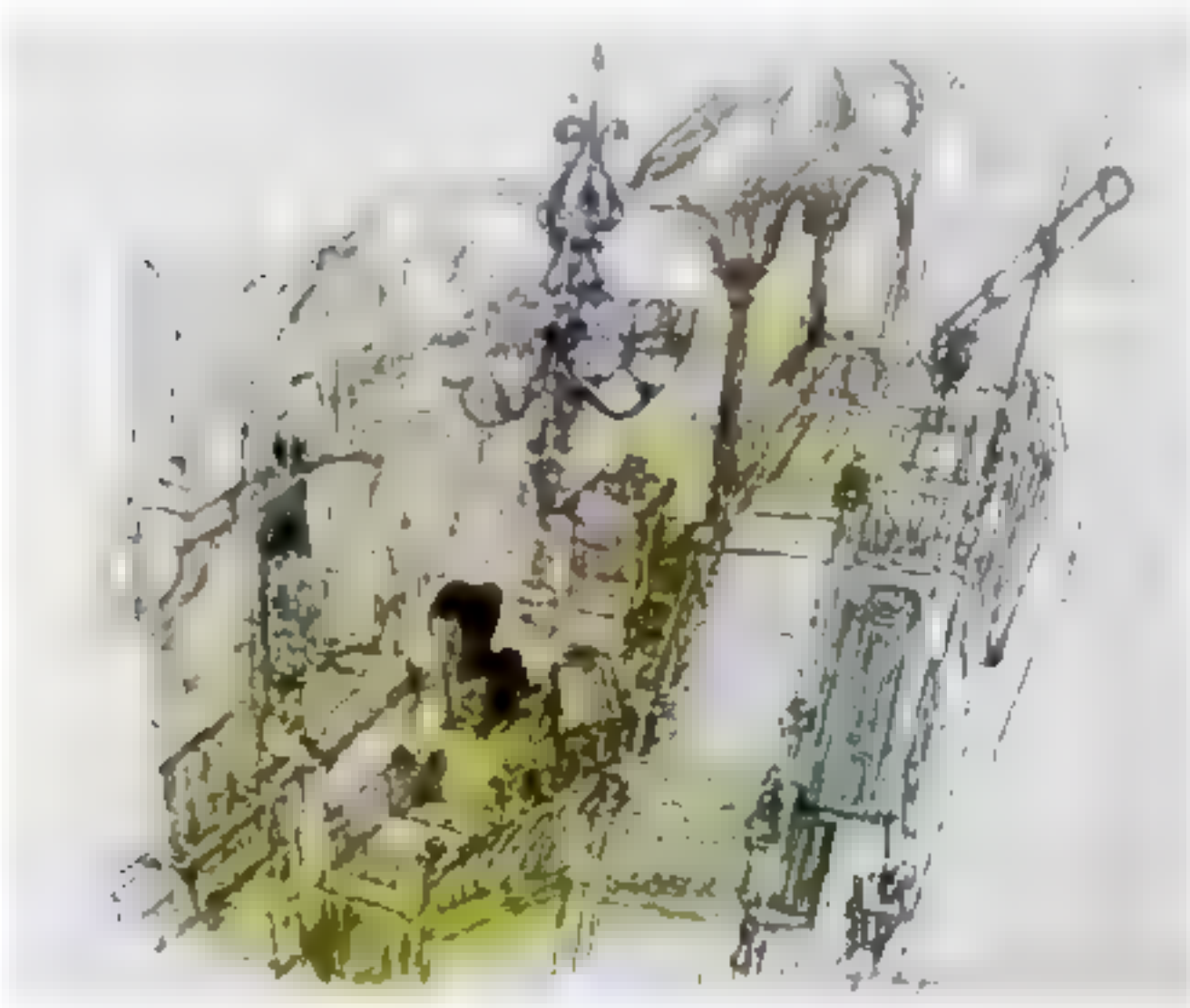
Unknown production

Ray Aragon

BOTTOM Watercolor sketch of a haunted mansion exterior (1978)

Unknown production

Ray Aragon



going to come back from Mexico with a bunch of crap!" Because if he couldn't do that around here, why go to Mexico?

You don't have to go to Paris and paint the Eiffel Tower. It's around you, man!

You don't need to visit a fancy location to learn how to become a confident layout artist. In Ray's view, you don't even have to leave your apartment:

When I was teaching layout at CalArts I would try to explain, and I would say, "Look, you are a camera! Now show me how you see the scene. Do a drawing, I don't care what the subject is. Say you're looking down and maybe there's a door over here and a person has just come in? Draw that person over there and then that person is talking this way, to you, to the audience, to the camera!"

"And I want a couch, too, I want a piece of furniture here, something else there, but don't get these little tiny things, don't do detail! Don't give me fancy little doo-dabs! Give me solid shapes! The couch is long and oblong and this way, the other thing is upright, you might have a round thing in there too, so you can identify these pieces of furniture. Make them definite shapes so you can identify them. And the door and a window, too, and you [can] place these things wherever.

"Now we cut: now you are a camera, the eyes of the guy down there! Or maybe the camera is *behind* the guy down there? If he's looking up at the stairs here, where are all these things at now?! Now you'll go over there and you show the back of the guy's head, so that means that he's here, or maybe you do not show him, instead you see what he sees? So that means that you are the camera! And you move around!"



But with the students who weren't interested it was really hard. I would say, "Look, make blocks! I don't care what you use, just make anything to indicate figures! Go to your kitchen table, get that box, get that shape, get a round bowl, get a horizontal, oblong, squat box, get any prop, put them on that table and draw them! Then you get on your knees and you draw the same objects looking up. Or you go around the table or you sit on a ladder and draw them looking down. But get those things in position. Move around. You are a camera! Draw what you see! I want to see those props! Boxes! Do that tonight and I want to see them tomorrow!"

That's how you learn to position things! And to identify things! And that's how you let the audience know where they are.

That's the way I learned, to just move around as a camera. But some of the students could not cope, they could not understand. I said, "You master this thing on your kitchen table right here! Get over here and draw what you see. After a while, it's going to sink in and you'll be able to do it without looking at the objects, you can position things in your mind!" That's what I was teaching.

A BUNCH OF WONDERFUL PEOPLE

There was tremendous passion and determination in all that Ray said, none of it spoiled in any way by the slowness of some of the students to catch on to what he was telling them and appreciate its significance and simplicity. Ray was troubled, however, by what seemed to him to be a change in mood among the artists and technicians creating some of the new animated features:

I worked freelance a little after I retired and I watched these young kids—and they didn't horse

around! They didn't fool around, they didn't have lunch together, they didn't go to each other's homes while they worked together that much. Not like the Disney guys. I didn't see this spirit of fooling around, joking, laughing, slapping the back! Showing each other their drawings. I said to myself, "Are they afraid? Has the business come to the point where they're afraid?"

For Ray and all the other artists around him, the animation community that existed in the '50s and '60s in Los Angeles was, for all its faults, a creative oasis, unique in the world of commercial design, encouraging the kind of collaborative spirit that, in the outside world of advertising agencies and freelance work, curdled so easily into something more combative:

All of us in animation, we were all just pals. Not like, say, in the advertising business. I had a friend from Chouinard who ended up being one of the art directors at a commercial company over in Hollywood and they were cutthroat. He spent many, many years fighting these guys. And these guys were bastards, they made life miserable for him. But he stood up to them and he survived and he finally retired. I would tell him, "In animation, we're all just friends, you know?"

People ask me, "Was there a competition at Disney's?" Because we used to show each other our drawings. Was it a competition? Yes and no. We showed each other our stuff that we did at home to show off, to show to our contemporaries, and it fired us up! It wasn't called "competition!" It was called, "Let me show it to him!"

I worked at Hanna-Barbera, in every studio in town, we were that kind of a crowd. We were

happy-go-lucky! Friends. Animation, cartoons, whatever, that whole industry, especially the animation part. I worked for Joe Barbera a lot and we were just a bunch of great people! The camaraderie! We knew each other! I was just an artist! We were just guys that drew!

I wasn't happy in advertising and I got into animation because Marc Davis came along and he made it possible for me to go to Disney's. He changed my life! We just did our job and we were happy at it. Then all these years passed and people that I don't know, know my name! This is amazing to me!

My career in the movie business, in animation and live-action, was nothing but sheer joy! I loved it! I always did! We all did, you know?! It was a bunch of wonderful people.

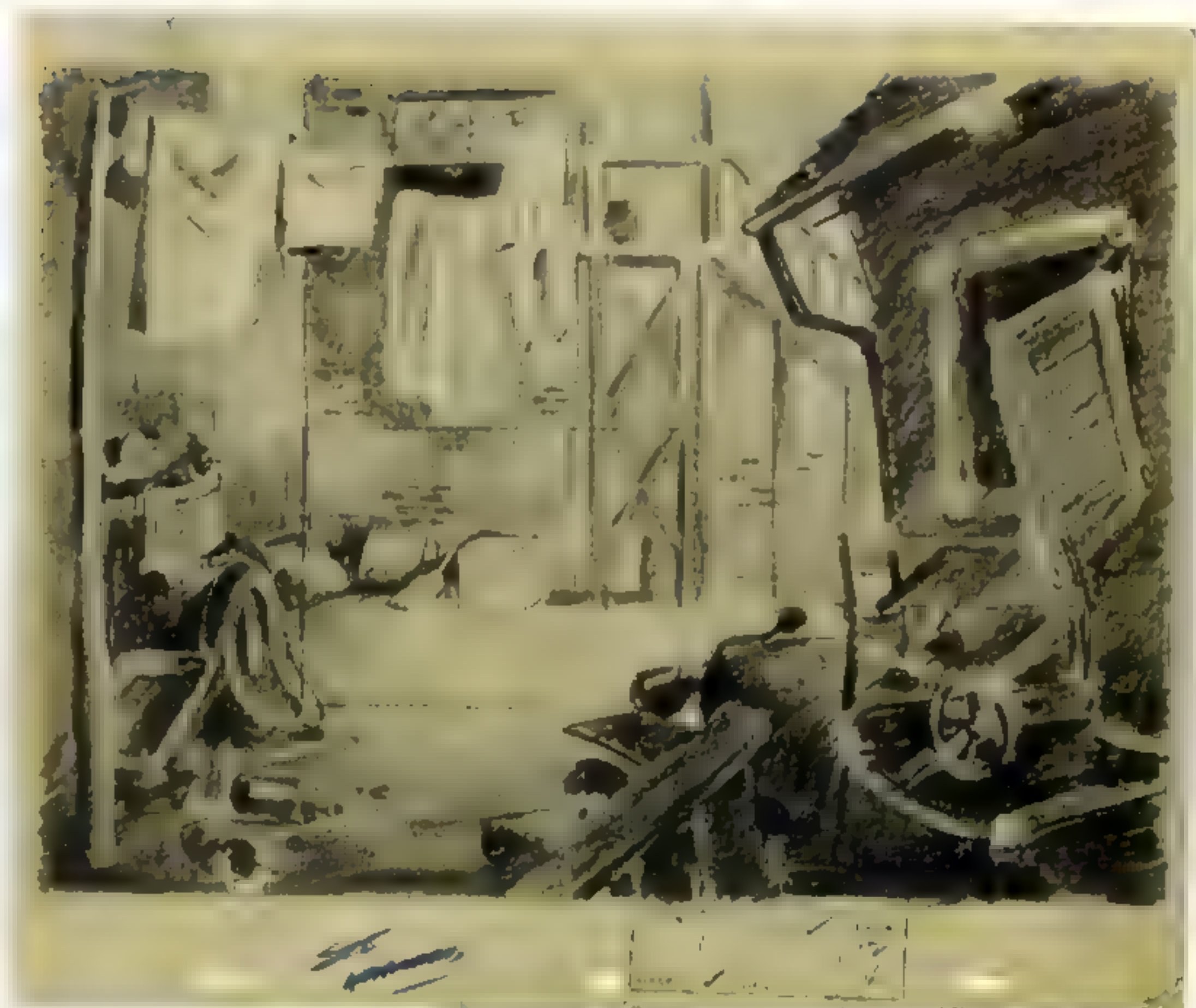
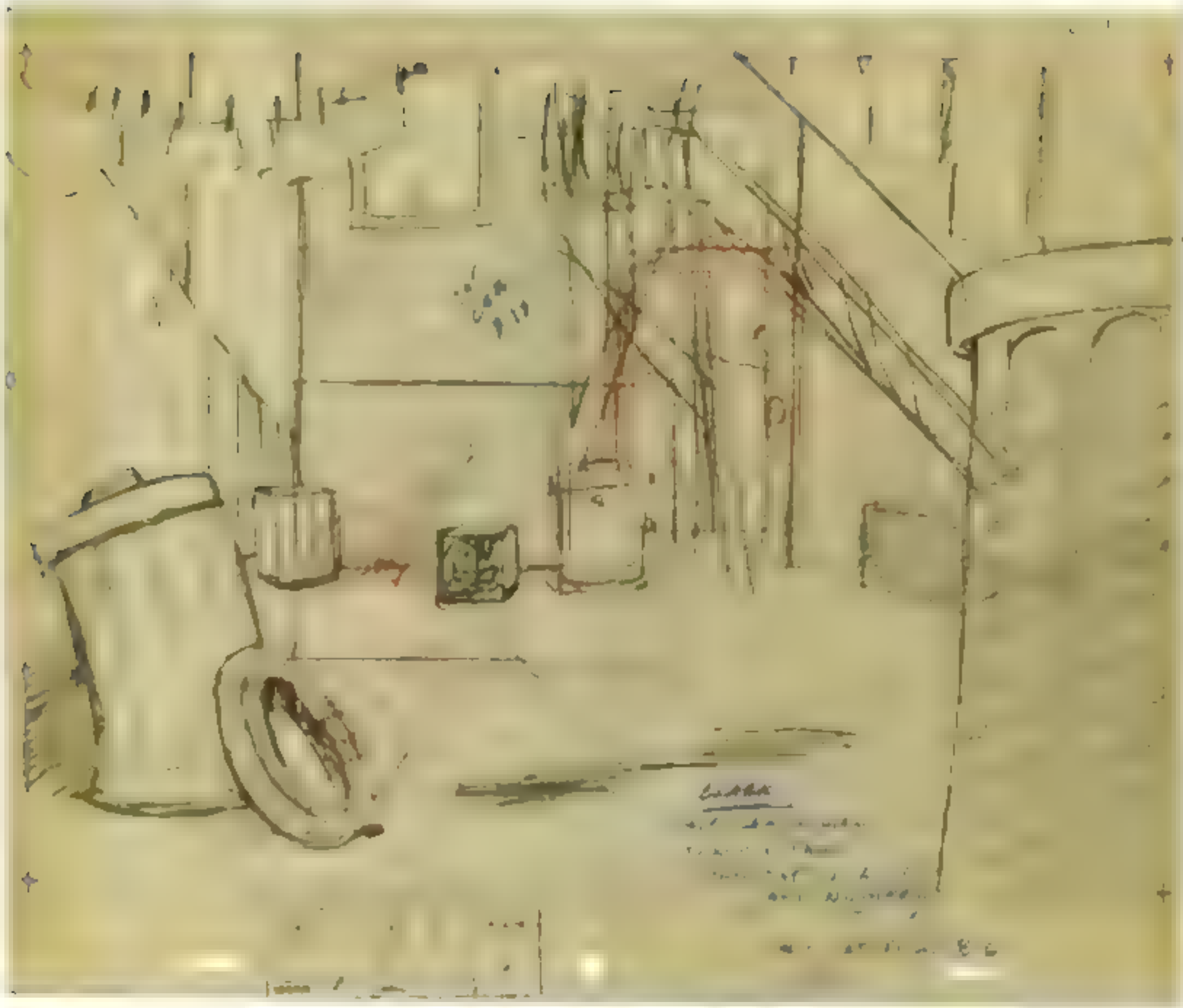
—Ray Aragon, 1926–2009

Endnotes

1. See glossary.
2. "Memories of London."
3. CalArts was established in 1961 by Walt and Roy Disney through the merger of two professional schools, the Los Angeles Conservatory of Music and the Chouinard Art Institute.

One of the few remaining examples of a surviving rough sketch from the 1940s with which the cleaned-up BG Layout can be compared; in the later version the foreground trash can has been replaced with a broken-down car while the tonal and linear composition have been refined to draw attention more effectively to the character's position at the end of the alleyway.

Rough and cleaned-up BG layout drawings, graphite
The Cat in Hat's Pajamas (1948) MGM Cartoons
Directed by Tex Avery
Layout artist unknown



POSTSCRIPT: DUMPSTERS AND STATION WAGONS

Animation itself usually begins with the piecing together of a story. Sadly, over the years some of the most important pieces of this particular story have long since gone missing. As more than one traditional layout artist explained to me, character layouts in particular were often thrown away within hours of being drawn, while sometimes it's anybody's guess which particular artist created any one of the individual background layouts that have survived from the older studios. For every original background painting that made it safely into an archive or a private collection, hundreds have been lost or thrown away.

As the apparatus of production has been developed, modified, and ultimately digitized, important pieces of physical machinery like rostrum cameras have also vanished, disappearing from dark studio basements to be replaced, on bright tidy desktops, by their slim-line virtual equivalents. With the arrival of the digital pen and tablet, even the marks made by the artists themselves float in an all-too-volatile digital ether from which only a printer can save them.

How?

By committing them to what is still the safest and most stable storage medium known to humankind: paper (at which point, of course, the printed images become vulnerable once again to all the old-fashioned risks and threats).

Perhaps, whatever the medium, all artwork that is designed to be mechanically reproduced and commercially distributed runs the same risk: with so many copies being readily available in so many formats, what kind of value can possibly be placed on the original? And with the profusion of individual pieces required for a single second of hand-drawn animation to make it onto the screen, where on earth would even the wealthiest company or

individual ever find enough shelf space to keep the mass of material generated by one production after another?

Most character animation drawings and painted cels at least have the advantage of being a convenient size for framing and collecting. How many people have walls at home long enough to display gigantic panning backgrounds? And how would even the most enthusiastic collector make space for an awkward, L-shaped blue pencil layout, no matter how beautifully rendered it might be? It's perhaps not in the least bit surprising, then, that so much layout and background artwork in particular has been lost or, at best, chopped into sections for mounting in gallery-exclusive cel setups. Nor is it surprising that the disappearance of so much artwork should, in turn, have generated so many stories.

Over the course of my research, I was told agonizing tales of original animation artwork being consigned to bonfires, hurled into dumpsters, and even plowed into giant, specially dug trenches (sometimes out in the desert, for whatever reason) so that heartless studio managers could clear the accumulated mass of sketches, drawings, cels, and painted images from their premises. One particular recurring story, often set in the 1950s, involves the lone studio employee, usually a security guard, who, on hearing that a clear-out is imminent, backs his station wagon up to the studio dumpster at night to save what he can before it's too late; in other versions of the same story the artwork, once saved, is then passed through the studio gate, one parcel at a time for a few bucks a scene.

While the details in some of these stories may, in true animation tradition, have been "plussed" along the way, much of the evidence has a horribly authentic ring to it. I mention the stories here because in the course of producing this book, I have been made all too aware of the vulnerability

not only of the older, tangible items of original animation artwork but also of the profusion of more recent *intangible* pieces that are only ever as safe as the storage medium to which they are consigned when the artist or (where they exist) the studio archive manager hits the SAVE button.

When I myself first became aware that there was a department, a process known as "layout" in animation, my assumption was that a "layout" drawing was a simple pencil version of the background artwork, a blueprint from which the final, color version could be painted. Moving from one studio to another over the years, I began to appreciate that an experienced layout artist had to be able to imagine, anticipate, and plan for the needs of almost every department in the production process, from the story artists through to the accountants. If, at the time of writing, all too few people, even within the industry, are fully aware of the pivotal role played by the artists and technicians who take responsibility for layout in all its forms, how much more difficult will it be for future generations to understand and appreciate these skills if the relevant artwork hasn't been collected and catalogued?

Respect and thanks are due, therefore, to all the individual private collectors and hardworking studio archivists who have made so many beautiful items available for inclusion in this book. Within the medium of animation, artwork of all kinds has to be created in order to bring characters and stories to life. Surely we owe it to the characters behind all that artwork (not just the animation drawings) to preserve and celebrate their handiwork, so that the audiences and filmmakers of the future can appreciate their skills and know their stories too?

Very few film technicians live to see their name become synonymous with a piece of apparatus, but for many animators around the world, the name Oxberry was (and still is) synonymous with the rostrum camera. Here we see John Oxberry, perhaps the best known designer of animation rostrum equipment, experimenting with focal plane at age 16.



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GLOSSARY

Note: Bolded words either are being defined (including subdefinitions) or are referring to another glossary entry. When the meaning of a word, such as “director,” is clear within the definition of another word, it is not bolded, even if it’s formally defined elsewhere in the glossary. Words are bolded only once within a definition.

Bolding is also used to articulate abridgments in definitions, e.g., “Mo-cap (motion capture).”

“A” peg(s): the round or center peg in any group of three animation registration pegs over which the photography of a particular hand-animated scene starts; term used to distinguish this center peg from the next (identical) peg or pegs on a multipeg (or “panning” peg bar) over which the animated action may continue, with each subsequent center peg being labeled accordingly, “B” peg, “C” peg, etc. (see also panning paper); “A” pegs refer to this round center peg plus the two neighboring rectangular ones.

“Academy” ratio: see aspect ratio.

“Academy” system: see fielding.

Aerial image photography: predigital frame-by-frame image compositing technique involving the photography of both “solid” and projected elements (the latter being referred to as an “aerial” image because the beam of the projected image does not “land” on a solid surface); often used to combine live-action footage with hand-animated elements from cartoon characters to movie title graphics (see also bi-pack and optical printer).

Air brush: electrically powered air compression device used by illustrators to distribute a line mist of premixed paint from a small chrome reservoir.

Animatic: a more sophisticated form of story reel; both involve scanning (or photographing) the individual hand-drawn panels of a storyboard and then editing them together in synchronization with the rough (or “scratch”) version of the music, dialogue,

and sound effects of a particular movie sequence (see also Leica reels and pose reels).

Animation

Character: animation that concentrates on the movement, performance, facial expressions, and lip-synch of a character or characters.

Special effects: animation that concentrates on the movement of elements such as water, fire, smoke, and explosions, as well as natural phenomena such as leaves or raindrops, and minor props.

Traditional: animation featuring hand-drawn characters and hand-rendered background artwork.

Animation discs: most animation drawings, whether for character or for special effects work, are predominantly made up of curved lines, which are easier for the artist to draw using the natural hinge of the wrist to help create the line in one smooth movement; when drawing a circle, for example, it is easier for a right-handed artist to draw the left side of the shape; to make it easier for any artist to draw any curve, no matter where the curve may appear in the completed image, animators, assistants, and inbetweeners work on desks or drawing tables equipped with a rotating, translucent disc; by repeatedly turning this disc as they work, they can more easily draw all the required curves from the optimum position, whether they are left- or right-handed; by positioning a light behind the disc they can see through several layers of paper, allowing them to refer more easily to the relevant key drawings, timing charts, and sketched arcs of movement as they create the required breakdown or inbetween drawing.

Animation paper: peg-registered/hole-punched paper.

Anticipation (in character animation): the initial movement or gestures that an animated character makes in preparation for a larger movement, e.g., crouching before jumping or twisting the body before throwing a ball.

Arc

Animation: the curved path of a character

movement, e.g., the “line” described by the movement of a limb or the turn of a head.

Story: the gradual development of a character’s attitude or behavior as the character learns and changes in response to the events within a narrative.

Artistic coordinator: Disney job description for a person who tracks the progress of all the hand-drawn and digital artwork elements on an animated feature.

Artwork

Background: different levels of scenic artwork used to create the environment for an animated scene; in “traditional” animation these flat elements are usually divided into BG (the equivalent of a theater backdrop), UL (underlay), and OL (overlay); elements that sit beneath the character artwork are labeled UL elements; those which sit on top are marked OL. If, in the course of a scene, a character appears both in front of and behind any scenic element, it will be labeled as OL/UL.

Concept: artwork that explores the different visual and design possibilities of a movie’s (or game’s) story, characters, and environments. Practitioners are known as concept artists.

Development: artwork created during the pre-production period of movie, animation, or games design.

Digital or virtual: artwork that is created inside the computer and has no physical presence until it is printed.

Effects: levels of rough or cleaned-up hand-drawn animation artwork representing special effects elements such as water, fire, rain, explosions, etc.

Line: drawings in which there is no attempt at shading or rendering of textures, only an outline.

Rough(s): rough sketch artwork produced by any of the traditional animation departments; term also used to describe photographed (or scanned) sequences of this same rough artwork.

Tangible: traditional artwork that exists outside of the digital (or computer) environment.

Aspect ratio: screen format as defined by the ratio of width to height of the image rectangle; usually expressed as, e.g., 1.85:1, 4:3, 1.33:1, etc. The “Academy” (or Academy of Motion Picture Arts and Sciences) ratio is 1.375:1.

“B” peg(s): see “A” peg(s).

“B” roll (in live-action film editing): film shot from a secondary or alternative angle by an additional camera.

Background (BG): see artwork, background.

Background layer: scenic element (or character/crowd level) that appears behind the main characters in a scene.

Background layout(s) (rough and clean-up): in traditional animation, often rendered in blue pencil, indicating all the individual levels of flat scenic artwork required for a scene; in rough form (see also artwork, rough) these may be sketches or line drawings only. At the clean-up stage, the original roughs will be tidied up by the layout artist, attention being paid to any outlines with which character or effects animation artwork will need to register (see also registration); traditionally rendered layout drawings are still created in some CG animation studios, but tend to be used for reference and guidance only by the digital artists.

Barrel distortion: the effect on straight and/or parallel lines of certain camera lenses which, when the photographed image is printed, appear curved in comparison to the frame or edge of the picture. Depending on the required effect, illustrators and animation artists may choose to “correct” this when working from photographic reference material or they may choose to introduce it to a hand-drawn image in order to duplicate the effects associated with these same lenses without requiring the camera operator to attach, for example, a wide-angle lens to the camera when shooting the scene.

Beats (story/performance): the main “punctuation” points (or “landmarks”) in a story or performance.

(Camera/rostrum) Bed: term sometimes used to describe the “compound” table on an animation rostrum camera.

Bézier curve: mathematically defined curve used in computer graphics display, invented by the French mathematician Pierre Bézier (1910–1999).

BG (background): see artwork, background.

Bi-pack: predigital frame-by-frame photographic technique in which a preexposed positive film print is held in direct contact with a matching length of film negative in a “process camera” so that individual picture or matte elements can be exposed from the former onto the latter; by rewinding the negative and repeating this process a number of times, the final desired composite moving image can be created from a number of separate elements (see also aerial image photography and optical printer).

Blocking (out)

In cutting/editing: establishing in rough form the most important moments, events, camera angles, and picture edits in an animated scene or sequence.

In performance/character animation: establishing in rough form the most important or extreme movements and positions of a character.

Of the character and camera in layout: drawing out in rough form the key positions of the character performance(s) in a scene and relating these to the composition of the scenic or background elements with which the characters will share the screen.

Blue sketch: a traced sketch done in different-colored pencils in which key character drawings and camera information have been recorded so that background artists can better determine the extent of background art necessary. As Dan St. Pierre explains: “If there’s a key drawing where the hands go way up and it breaks the field line, the background painter has to know that. And if, for example, the character walks from A to B in an interior, you have to know whether they interact with the furniture or not, whether the character animation has to register to the scenic elements at any point. Is there an overlay? Can the characters walk behind it cleanly? Or is there a registration mark? It’s a money-saving and time-saving procedure because you don’t want to paint any more background than you absolutely have to—only what the camera’s going to see—so you need to have the scene-planning component in place before all of that gets done.”

Blur: controllable digital effect used to simulate variable focus on a digitally modeled object or on a level of flat artwork that has been scanned into the computer.

Board: abridgment of “storyboard.”

Bongo zip-out(s): musical percussion cue (or cues) in Hanna-Barbera cartoon series such as *The Flintstones*, in which a rapid pattern of beats played on the bongos is typically used to accompany a cycle of animation in which a character’s feet run in midair before finally contacting the ground, at which point the character exits (or “zips out” of) the scene.

Bottom pegs: special discs are manufactured for the planning, checking, and photography of hand-drawn animation, each equipped with one adjustable sliding peg bar at the top edge and another at the lower edge of the drawing area (or image rectangle); some animators prefer to work with the sheets of animation paper attached to a peg bar at the top of their desk (or light box), while others prefer to work with the pegs at the bottom; in some instances this choice is made by the director or dictated by the practical considerations of how the character cel artwork will have to be photographed with the required scenic artwork; in some cases the BG, OL, and UL elements will deliberately be created on paper or board with the registration pegs at the top to allow the rostrum camera operator to move these elements, one frame at a time, from left to right beneath the camera, for example, while the character cels either remain stationary on the lower (“bottom”) peg bar or move, a frame at a time, in the opposite direction (see also animation discs).

Bounce light: light that illuminates a character or object indirectly having first “bounced” (or reflected) off an intermediate surface.

(Key) Breakdown (type of drawing): animation drawings that represent the most significant midpoint (sometimes but not always halfway) between two key drawings in any animated scene.

Breakdown (of soundtrack or dialogue): the process of establishing at which frame (or frames) in a scene or sequence particular vocal or musical sounds occur; the marking down of this information on an exposure sheet or bar chart, which will then be used as a guide by the animators and

assistants (and inbetweeners, if the production is hand animated) in the frame-by-frame timing of a character’s bodily or facial movements.

Bullpen: colloquial name given in some animation studios to a large room in which several animators work alongside one another.

Business: action, movement, and responses of one or more animated characters, possibly abbreviated from the term “funny business,” meaning choreographed comic or slapstick action in a live theater performance.

CG/CGI: Computer graphics; Computer-generated images (or imagery).

Camera, rostrum: movie camera designed to make single-frame exposures of animation artwork; it is positioned on a metal tower or stand that holds it over a flat surface (or “compound” table, also sometimes known as the camera “bed”); the table, in turn, is fitted with precision-g geared movable peg bars on which the different levels of artwork can be positioned and repositioned as required beneath the lens; flat cel and scenic artwork elements placed on the compound table are generally lit diagonally by lamps positioned to either side of the camera body, but most tables are also fitted with an area of frosted glass behind which additional, smaller lamps are mounted; this allows artwork positioned over this area of the “compound” table to be lit from behind if necessary; “back light” tends to be used mainly for photographing special effects and matte artwork.

Camera angle(s): the chosen positions from which a movie (or animated) scene is to be photographed; in both live-action and CG animation the camera can be moved to various different positions relative to the performers, scenic elements, and props; in hand-drawn animation the camera itself remains fixed at all times with the film plane parallel to the flat artwork elements positioned in front of the lens; this means that the animators and the layout and background artists all have to create artwork in which their skilled use of illustrative perspective creates the illusion of “camera angles” even though the angle between the camera itself and the flat surface of the various artwork elements never varies.

Camera diagrams: peg-registered drawings, usually made in red, indicating the required camera framing (or fielding) of a scene, the START (first frame) and END (last frame) positions of the camera relative to the artwork, and the path or trajectory of any required camera move (or moves); perpendicular “notches” representing the camera center at each successive frame of the scene are often drawn along the line of this trajectory.

Camera instructions: clear handwritten instructions for the camera operator, which are included in the “Camera” column on a traditional animation exposure sheet.

Camera lucida: (Italian: *camera* [room or chamber], *lucida* [light]) prism-based optical device popular with landscape and portrait artists in the nineteenth century, used to help “fix” the position and relative scale of objects or facial features on a blank sheet of paper.

Camera obscura (Italian: *camera* [room or chamber] *oscura/a* [dark]): lens-based, pre-photographic optical device or technique used by painters, particularly in the sixteenth through eighteenth centuries, to capture a brightly lit scene by means of projecting the daylight image onto a flat white (or translucent) surface in a darkened room or box (cf. Hockney’s book *Secret Knowledge*).

CAPS (Disney’s Computer Aided Production System): the computerized animation production system first fully implemented on *The Rescuers Down Under* in 1990.

Capturing (an image): making a photographic or digital exposure or scan of a physical scene or object, a piece of flat artwork, or a digitally rendered model.

Casting the shot: an animator “casts the shot” by means of a verbal handoff to the camera operator and/or scene planner; this process allows the animator to describe his or her full intent with regard to camera movement, as the “Camera” column on an exposure sheet only allowed enough room to define part of the required mechanics on any more complex scene; typically this handoff might involve the animator saying, “OK, we start here on these pegs and then the animation will move down the paper to the bottom, then I’ll jump to these peg holes and start the animation at the top of the paper again to hook up smoothly . . .”

Cel: abbreviation of celluloid, term used to describe an individual sheet of clear plastic onto which the outline of a hand-animated character is either traced or photocopied.

Cel animation: animation produced using the above technique.

Cel paint: specially manufactured paint that can adhere to animation cels and that will remain at least partially flexible when dry; applied to the rear or underside of the cel and used to color in the open areas of a hand-drawn animated character once the outline has been traced or copied over.

Character layout(s): rough line drawing(s) created by the Layout Department indicating the intended key positions of the character(s) in a scene; intended as a guide for the character animators.

Character staging sketches: rough drawings indicating the manner in which the main character(s) will move and perform within a scene.

Charts (timing): small hand-drawn diagrams, usually included in the top corner or outside edge of a lead animator's key drawings, indicating the required position and timing of the breakdown drawings to the assistant animator (character or effects); where the character's head, for example, is moving at a different speed from the arms, separate timing charts have to be made indicating the precise timing of each.

Checking board: see bottom pegs.

Choreography: design and planning of character movements within a scene or sequence (or of different special effects, background, or scenic elements); also used to refer to the planning of camera movements and edit points.

Cinematic(s) (noun): term used in the games industry to describe the short, movie-quality sequences that introduce, frame, or punctuate the interactive gameplay experience. Also known as cut scene(s).

Cinematographer or director of photography (DP) animation: the equivalent person (or persons) on an animated production (in any medium) to the person on a live-action

crew whose responsibilities are outlined below; because of differences in the practical procedures and departmental division of labor in animation, cinematography on an animated production can involve several different artists and technicians working collectively.

Live-action: person responsible for working with the director, production designer, and performers to establish the lighting scheme, image framing, and style of camera movement appropriate to each scene or sequence in a movie; also responsible for deciding which lenses and film stocks to have available for shooting under the full range of different circumstances likely to be encountered.

Clapper board: see slate/slating.

Clean room: dust-free environment whose temperature and air supply are isolated from the surrounding rooms, usually to facilitate the smooth running of sensitive machinery (particularly early and/or primitive computer equipment).

Clean-up: the process in hand-drawn animation of redrawing the rough character and layout artwork by tracing it onto a separate, clean sheet of paper with a sharper, steadier outline and/or a less sketchy rendering of the surface details.

Color card: a piece of art board, paper, or card evenly covered with a continuous layer of paint of a single color without any modulation in either tone or hue (see also sky card).

Color keys: small thumbnail paintings, pastels, or digital renderings of the color scheme for a particular scene or sequence.

Colorscript: collection of color keys for an entire animated movie.

Complexity (of scene or scene setup): term used to describe the number of separate elements or components required in any given scene; for reasons of speed and economy a "complexity pass" is used to find ways of simplifying any scenes that are unnecessarily complex.

Compositing (of images): the process of combining digitally, within the computer, all the different components of an animated (or live-action special effects) scene to create the final on-screen image.

This process has replaced a range of predigital techniques that required specialist photography.

Compound table: see camera, rostrum.

Continuity (visual/editorial/pictorial): In layout, the process of ensuring that, from one shot (or scene) to the next, the distances and spatial relationships between characters, props, and environmental features are kept constant; in animation the process involves making sure that from one shot (or scene) to the next, the movements of the characters and effects don't vary in speed, scale, or direction (see also hookup).

Convergence

In a convex or positive lens: the concentration of parallel beams of light toward a specific point beyond the lens; term also used to describe a particular pictorial distortion of objects common to wide-angle lenses.

Of human eyes: the involuntary and simultaneous rotation of both eyes to direct the gaze at a particular object.

Coverage (live-action/digital): the practice of filming action or performances either simultaneously with more than one camera or, over a series of takes, from more than one camera viewpoint.

Cut scene (games industry): see cinematic(s).

Cycles: groups of character or special-effects animation drawings that depict a repeating action and are designed to be photographed in sequence more than once to save unnecessary redrawing of identical movements; if, for example, 12 separate drawings are required to create the movement that is to be repeated, drawing no. 1 can also be used as drawing no. 13 without a perceptible break in the "arc" or continuity of the movement.

Deep Canvas: Disney's Academy Award-winning production software which allowed background painters to apply digital "paint" to computer-modeled 3-dimensional geometry, where previously either the geometry would have been flattened out for textures and surface details to be rendered on it in two dimensions or "flat" rendered areas of painted detail would have been wrapped around or projected onto the 3-dimensional geometry; first used on *Tarzan* (1999).

Depth of field: the range of distances from a physical (as opposed to digital) camera lens within which objects will appear in sharp (or acceptable) focus. Also known as depth of focus.

Digital age, the: period since the widespread availability and acceptance of computer hardware (and software) in both the industrial and domestic markets.

Digital laser film recorder: device for transferring digitally created imagery onto regular photographic film stock.

Digital special effects: computer-animated special effects (e.g., snowfall, water, or flames rendered using particle systems).

Digitizing artwork: the process of scanning, photographing, or otherwise capturing physical artwork (usually 2-dimensional items) and translating the visual information into the 1s and 0s of computer binary code.

Directions: instructions given by the director to character animators or performers.

Director: the person responsible for overseeing all creative and technical aspects of a live-action or animation production, from casting the actors and guiding their performances through to working with the film editor in order to establish the final cut of a movie.

Director of photography: see cinematographer.

Disbelief, suspension of: term attributed to the English poet Samuel Taylor Coleridge (1772-1834) generally used to refer to the willingness of audience members (or readers) to surrender their imagination to the portrayal of a "real" or imaginary world as presented to them in a film, stage play, or book in spite of the artifice of the medium itself.

Disc(s): see animation discs.

Dissolve: visual effect (achieved either photographically or digitally) in which one moving image is gradually replaced by another by means of matching a frame-by-frame reduction in the exposure of one image with the frame-by-frame increase in exposure of the other.

Down-shooter: a traditional film camera equipped to make single-frame exposures and positioned to photograph artwork that is laid out flat on top of a horizontal surface (or “compound” tabletop) directly beneath the lens; or a digital camera positioned in the same way.

Draftsman: artist (male or female) who specializes or excels in observational or technical drawing.

Editing

Animation: though similar in principle and technique to live-action editing, editing for both hand-drawn and CG animation starts at the preproduction stage before any final footage has been created; while unwanted material is routinely trimmed (cut) from the head and tail (beginning and end) of each live-action scene photographed, it is less common for any unnecessary frames of action to be animated, as all the required action and staging decisions are made in advance with precise scene lengths being established between the storyboard and animation stages of production by means of editing together a story reel or animatic that the editor creates from footage (or scans) of the individual storyboard panels, working in tandem with the director and the Layout (or Camera & Staging) crew to achieve the required dramatic structure and cinematic flow of the movie.

Live-action: the process of assembling the different scenes and sequences of a movie by means of joining together the separate shots and/or takes selected by the director from the material photographed on location or in the studio; the editing process also involves matching picture with sound, either by use of the original audio material recorded synchronously with the film itself or by means of track-laying dialogue, sound effects, and music that have been recorded separately (or after filming).

Emulsion (photographic): light-sensitive coating applied to a flexible celluloid (film) base.

Exposure (film/camera): term generally used to describe a single, 1/24th of a second period during which the aperture of a movie camera remains open, allowing the photosensitive emulsion of the original film negative to be exposed temporarily to light entering through the lens; term used in traditional hand-drawn animation to describe the photography of one frame setup of animation

artwork; double or multiple exposures are created in traditional, predigital animation photography by successively exposing more than one image onto the same frame of film.

Exposure sheets: sheets of paper formatted and printed specifically to allow an accurate, frame-by-frame record to be kept of all the individual artwork elements created for each scene of hand-drawn animation; exposure sheets are typically divided into horizontal lines (each representing a single frame of film) and three main sections of vertical columns: to the left of each sheet is a narrow column into which the assistant editor transcribes details of the specific frames at which the principal dialogue, music, or audio “events” occur (such as vowels and consonants in speech, beats in music, or footfalls in audio); a broader column to the right of this allows room for a written description of the action that occurs within the scene; a series of narrow columns appears in the center of the sheet, each representing an individual layer or level of character, effects, and scenic artwork—OL, UL, and BG (see artwork, background)—with either the rightmost or leftmost of these columns being designated to represent the level of artwork (usually the BG) that will be farthest from the camera lens (or closest to the “compound” table), the remaining columns corresponding, a level at a time, to each successive layer of artwork (usually on cel) that will be positioned above the BG artwork, in order, on the registration pegs; a wide column to the right of each sheet allows room for detailed and specific camera instructions to be entered as an additional guide for the camera operator.

Facial rigging: the process of assigning animation control points to the individual facial features, muscles, and surfaces (or textures) of a digitally modeled animation character.

Fade up/fade down (usually from black): the gradual increase or decrease in intensity and brightness of a movie image, similar to a dissolve but with the outgoing (or incoming) image being uniform black rather than another moving image.

Field(ing): measurement system based on variations of a rectangular grid in which the width of the basic unit rectangle is held constant at 1 inch while the height varies depending on the chosen aspect ratio; this measurement system operates by means of field guides (also sometimes known as graticules)

or rectangular grids which are printed on peg-registered cels that can be placed over the animation elements to help establish the specific area of traditional hand-drawn animation artwork that the camera is required to capture or photograph at any given point in a scene; with the exception of the Disney studios (see 5,000/5,000) the center (or origin) of each field guide would be considered as 0/0 with each rectangle above this point representing, e.g., one field North and so on around the points of the compass; because there are three more 1-inch-wide rectangles N, S, E, and W of 0/0 center in each quadrant of a 15-field field guide than there are on a 12-field field guide and because the height of the basic field rectangle varies according to the chosen aspect ratio of a production, the measurement “North” from the middle (or round) peg on a standard peg bar to this 0/0 center varies (e.g., the center, or origin, of a 16-field graticule is 5.75 inches immediately above the center peg). When associated with either aspect ratios or fielding systems, the term “academy” refers to those measurements or procedures that are recognized or advocated by the Academy of Motion Picture Arts and Sciences.

Field guides: see above.

Film negative: sprocketed celluloid strip coated with light-sensitive photographic emulsion that, when exposed to light and processed in the laboratory, results in a “negative” image, i.e., an image in which all the color and tonal values are reversed from normal.

Film noir: term coined retrospectively in Europe to describe a particular kind of low-budget 1940s or '50s black-and-white Hollywood movie, typically a thriller or detective story, often featuring overtly dramatic use of lighting.

Film positive: sprocketed celluloid strip coated with light-sensitive photographic emulsion that, when exposed to light and processed in the laboratory, results in a “positive” image, i.e., an image in which all the color and tonal values are identical to those seen with the naked eye.

Film recorder (digital laser): see digital laser film recorder.

Film sound: synchronized audio elements recorded “live” on location or on a sound stage and

combined by the sound editor in postproduction with other found or manufactured sounds and audio effects, usually non-synchronous (or “wild”); see also track laying.

Final check, Final Checking Dept.: traditional animation production department responsible for scrutinizing the initial renders of each scene, one frame at a time, to find any errors and arrange for them to be corrected before final output to film.

Final composite(ing): the final stage in digital animation production where all the required (and checked/corrected) elements of a scene are assembled in the computer in preparation for the final output to film.

Fine art(s), fine artists: term usually used to distinguish those artists, usually painters or sculptors who work on the basis of individual private commissions for unique pieces, from their counterparts in the field of commercial or industrialized design, illustration, and modeling.

5,000/5,000: Disney field guide system, also based on inches as a unit measurement, which assigned the number 5,000/5,000 to the camera center. Instead of determining distances from the origin in fields, each inch is broken into 100 increments so a position eight inches horizontally from camera center would be written as “16F East” using an academy graticule (see field) and 5,800/5,000 using the Disney system. The Disney system has some advantage over the regular field guide system in the computer environment because it’s a numerical system that gives positional information in hundredths of an inch without resorting to decimals or fractions. Because the standard unit of measurement in the academy system is 1 field, a horizontal camera move of less than half an inch had to be written as a fraction of a field. The center point or origin had been determined early on at Disney as 5,000/5,000 because this was the farthest distance that their rostrum bed (or “compound” table) could move. In order to avoid using negative numbers, they had determined that 0/0 should be at the bottom left corner of their rostrum bed, and that all the numbers should extend from that point. This made complete sense when animation camera operators were working within the physical limitations of a rostrum bed, but once they began working in the digital world where no such limitations existed, it seemed to those operators who were used to a 0/0 center to be “an abstraction too

far" since it was now possible to move the camera beyond the original Disney origin. Nevertheless, to avoid a hybrid of both systems, it was determined that adopting the 5,000 center would be easier. (definition courtesy of James Williams, Sony Pictures Animation)

Flipping (animation drawings): the technique used by animators, assistants, and inbetweeners of rolling down the top corner of three separate sheets of animation paper, one after another in rapid succession, so as to view the accuracy and effectiveness of the work in progress at the center of the sheet; most commonly a breakdown or inbetween drawing is created by placing a blank sheet of paper on the pegs over the two key drawings that immediately precede and follow it; by backlighting all three drawings on the Perspex animation disc, the assistant or inbetweeners can then see roughly where the intermediate lines need to be placed on the blank sheet, but the only real test of the fluency of the animation is to view the resulting image, top-lit, in sequence with the keys (see also rolling).

Flood-filling (digital color or paint): the technique, in digital Ink & Paint, of selecting an area defined and enclosed by a digitized line and then triggering the release of a chosen color of digital cel paint into that region by means of clicking on it with a computer mouse or digital graphics pen.

Flow (pictorial, compositional, and editorial): term commonly used to describe a pleasing continuity of character and camera movement from one scene to the next in an edited sequence.

Focal depth: see depth of field.

Focus: term generally used to describe the sharpest, most clearly defined image that can be perceived with the human eye or photographed through the lens of a camera (see depth of field).

Footage

Film: general term used to describe a length (or lengths) of film, video, or digitally recorded moving images.

Hand-drawn animation production: term used as a measurement of work accomplished in any one department or sometimes by one particular artist, defined in terms of the number of frames

of 35mm film that appear on screen in any one scene or sequence (8 frames of 35mm film stock being equal to 1 foot). Where more than one level of artwork has to be created or completed, this is sometimes credited to the artist separately for purposes of credit or remuneration; the term can also be used to describe a process of payment whereby an animator, assistant, or inbetweeners is paid according to the number of drawings he or she produces (and the film footage to which these drawings correspond) instead of being paid an hourly rate for the amount of time worked.

Foreground level, layer, object, element, or scenic element: any one of these component pieces (or levels) of animation artwork that appears in front of (or above) the main character in an animated scene or between the main character and the camera lens.

Foreshortening (in hand-drawn perspective): effect achieved in the process of rendering any 3-dimensional figure or object on a 2-dimensional surface according to the laws of pictorial perspective usually resulting, for example, in the larger part of an object being hidden behind (or pictured smaller than) that part which is closest to the observer.

Format (image/screen): see aspect ratio.

Fourth dimension (time described as): if height, width, and depth are the three dimensions within which objects and distances are measured in space, time may be thought of as the fourth dimension within which the duration of events can be measured.

Fourth wall: term used in theater, TV, and movie scenic design to refer to any set, usually a room interior, in which only three out of four walls are constructed, the actors' movements being staged to "read" to a live audience or to a camera positioned so that it views the performance through the nonexistent wall (much as a child would look into a doll's house).

Frame, framing: see compositing.

Full animation: hand-drawn animation in which every frame of artwork is different, as opposed, for example, to animation "on 2s" in which only 12 drawings are created for each second of screen time, resulting in every cel setup being

photographed twice to compensate for the missing inbetween drawings.

Full-length movie: see feature.

Gag(s): term used in theater, TV, and movies to describe short routines or specific moments of physical or verbal comedy; a gag pass is the stage in production of an animated movie during which opportunities are sought to create or insert such moments or routines.

Gameplay: the combined interactive experience of playing (and responding to the challenges of) a video or computer game; the quality of that experience as judged by the person playing.

Geometry (digital, 3D): term used to describe the (usually untextured) objects constructed and animated within a 3-dimensional virtual computer environment, these objects being commonly defined in the on-screen display by wireframe models, i.e., "see-through" objects defined by straight lines and mathematical curves suspended between stationary or moving points in the *x*, *y*, and *z* coordinates of virtual space.

Global illumination: default option available in a computer lighting toolkit to allow the general, overall illumination of digital geometry modeled and animated within the virtual computer environment.

Graphics (in games): the style or level of detail and/or realism seen in the on-screen rendering of objects and characters.

Graphics card: computer component that takes the raw binary information relating to virtual objects, distances, and lighting conditions and translates that into visual (or graphic) information, which can then be displayed on the computer monitor in a recognizable pictorial form.

Graphics tablets: rectangular drawing surface attached to (and powered by) a computer; the tablet is receptive to signals from a digital pen with which an artist can "draw" (or "paint"), the resulting images being displayed on the computer monitor.

Graticule: see fielding.

Head (of a scene or sequence): the beginning, the first frames.

Hi-poly (high polygon count): term used to describe a digitally modeled object (or objects) with a large number of individual facets (see also lo-poly).

Hi-res (also high res, high resolution): an on-screen or printed image of good quality, rendered using the maximum possible number of individual pixels (see also lo-res).

Hold (noun): term used to describe a single animation drawing or cel that is photographed on more than two subsequent frames; "held" drawings (e.g., in a story reel or animatic) would typically be single rough sketches representing what will, on approval by the director(s), become full animation; "held" cels or drawings in a regular scene are those drawings (or parts of a character) that aren't required to move, for example, a character's arm might move while the body remains stationary so the arm would be animated on a separate level, while only one drawing was used for the body so that identical lines wouldn't have to be redrawn on every frame.

Hookup: term used to refer to the beginning or end (head or tail) of any individual scene or shot, which must work in precise continuity with a neighboring scene.

Horizon line (in pictorial perspective): line, sometimes not visible in the final image, usually representing the camera's (or viewer's) eye level in any environment; the line at which the distant horizon is (or would be) visible to the viewer; the level on which one or more vanishing points (toward which all lines of horizontal perspective recede and converge) are positioned in a drawing or painting.

Hybrid production: animation production that combines the techniques and processes of traditional hand-drawn animation with those of digital computer animation.

Illumination: virtual lighting of computer-modeled sets and models (and sometimes of digitized flat animation artwork elements).

Image format: see aspect ratio.

Immersive experience (in games and/or movies): a particularly absorbing and convincing experience for the audience member or game player in which a precise coordination of visual and

audio stimuli results in a feeling of close personal involvement with the characters and events in a movie or game.

Inbetweens/inbetweening/inbetweeners (Character and Effects Animation Departments): the last of the animation drawings to be created following (and fitting “in between”) the assistant animators’ breakdowns.

Increments: small measurements of change in the position of artwork elements mounted on moving peg bars beneath the camera; gradual frame-by-frame movements of the calibrated gear wheels controlling the position of these peg bars, often increasing or decreasing marginally, frame by frame, over a particular frame range to produce a “cushion-in” or “cushion-out” effect, also known as an “ease in” or “ease out.”

Ink & Paint (traditional, digital), Ink & Paint Department: originally the department responsible for hand-tracing the animators’ pencil lines onto the top side of a cel using a pen or brush and then applying paint to the rear of the cels to fill in each separate area of color within the character outlines; from the 1960s to the early 1990s, although the painting was still done by hand on cel, many studios saved time and money by transferring the animators’ pencil lines onto the cels by means of xerography or photocopying; from the mid-1990s onward it became possible to scan and digitize the line artwork so that the painting could be done within the computer, each closed area being filled (or “flooded” with color) at the single click of a computer mouse (see flood-filling).

Interactive games(ing): computer games that respond, by means of manual controls, to the input and actions of the user or player; games in which the outcome is determined in part by the choices and actions of the user or player.

Jump pegs: any temporary peg bar not internal to the camera “bed” (or “compound” table).

Key drawings: drawings created by the lead animator (using the rough character layout drawings as a guide) that represent the most important (or “extreme”) positions and poses an animated character is shown in over the course of his or her

movement or performance in any given scene; the same term is applied to drawings created by the lead special effects animators.

Keys (in a sequence)

A lighting key is a small graphite drawing or ink/marker sketch, usually done in monochrome, indicating the desired lighting scheme for any given scene.

A color key is a small full-color painting or pastel sketch indicating the desired color scheme for any given scene.

Laboratory (film processing): once exposed, the original film negative goes to the laboratory to be processed, the resulting negative film images then being immediately transferred to positive stock for projection and editing purposes (the original negative is kept safely at the laboratory until the “neg cutting” stage); in the predigital era certain additional image-manipulation processes were undertaken at the laboratory (e.g., color variations could be achieved by altering the timing and chemistry of the printing process), but most of these effects are now achieved in the computer during postproduction.

Landscape: term used to refer to a horizontal rectangular image format or composition (as distinct from portrait, which refers to a vertical rectangle).

Launch(ing): the issuing of a completed sequence workbook to the Layout Department.

Layer: single flat scenic or animation level or element in a multilevel scene (in traditional or digital production).

Layout: see character layout(s) and background layout(s).

Legend: traditional or digital painting used as a key or color/tonal/rendering guide for all the other scenic paintings in a given movie sequence (or cinematic/cut scene sequence or game level design).

Legibility: the degree to which a character (or entire screen image) can be “read” clearly by the audience; usually dependent on the use of clear silhouette poses and strong tonal differentiation between foreground and background objects.

Leica reels: name (derived from the German manufacturer of a particular kind of movie camera) given to the filmed (or videotaped), timed version of the storyboard for an animated TV commercial or series episode (see also animatic, pose reels, story reels).

Level(s): see layer(s).

Level design (games): the design of each successive computer game environment in which the on-screen character (or avatar) will encounter various events and challenges, successful progress through one level resulting in access being granted to the next.

Lighting camera person: see cinematographer.

Lighting Department (in CG animation): the group of artists and technicians responsible for implementing the lighting choices made by the director, art director, and cinematographer by positioning and controlling the virtual light sources within the computer environment.

Limited animation: animation produced using fewer separate drawings for each second of on-screen action (usually fewer than twelve per second, i.e., animation that relies on large numbers of single elements that are “held” or reexposed on more than two subsequent frames); see full animation.

Lip-synch: matching a character’s mouth positions to the recorded dialogue.

Live-action: term used to distinguish photography of “real” human performances from the creation of virtual or hand-drawn animated performances.

Live-action reference: footage of a live performer (or performers) photographed for use by character animators as frame-by-frame reference material; also used in special effects for the study of complex natural phenomena such as water and foliage, the footage often being created using time-lapse techniques to allow closer examination of fast-moving phenomena such as water droplets or flames.

Location (live-action): any nonstudio area, exterior or interior, in which a movie performance is filmed (e.g., a city street, train station, or mountainside).

Locked-off (camera position): any position in which the body and lens of a movie camera are deliberately prevented from moving in any way.

Locking (a sequence): prohibiting any further changes, amendments, or additions from being made.

Lo-poly (also low poly, low polygon count): a digitally modeled object (or objects) with a small number of individual facets (see hi-poly).

Lo-res (also low res, low resolution): a digital picture that has been rendered using only a small number of individual pixels, fewer than would be required to achieve optimum image quality (see also hi-res).

Matte: in traditional animation, a piece of artwork, usually rendered in black paint on peg-registered cel, designed either to conceal or to reveal some specific part of an artwork element during multiple-exposure photography (or during digital postproduction); a hand-traced matte element is generally traced onto cel, one frame at a time, from a projection or peg-registered printout (stat) of each successive live-action or animated image in a scene; a positive matte usually acts as a window through which something can be seen, a negative or inverse matte usually acts as a mask, preventing something from being seen and/or photographed; mattes themselves tend not to be seen in the final image, rather they are used during postproduction, optical work, or digital compositing to help create the desired on-screen effect by controlling exactly which parts of each artwork element are photographed by the camera or rendered by the computer; often mattes are used to create registration between animated characters and particular details of a single-level background painting, e.g., something behind which the character must appear to walk; hand-drawn mattes are also used extensively in the frame-by-frame registration of animated characters to live-action performers.

Articulate matte (also artic or traveling matte): any matte that has to change, frame by frame, to follow or track the movement of an animated character or object or part thereof, e.g., a series of mattes that correspond to a character’s hand gripping a banister, which itself is rendered on an OL artwork level positioned in front of the character artwork.

Matte painting: a highly detailed, realistically rendered piece of scenic artwork usually painted on glass, through which the camera will then photograph the performers; often used to economize either on the construction of elaborate sets or on expensive location shooting in dangerous or inaccessible places.

Mechanics (of/for animation camera movement): the numbers and fielding coordinates, accompanied by diagrams, written instructions, and framing instructions, used to define the specific angle, trajectory, and speed of any required camera movement in an animated scene.

Model sheet: sheet of drawings created in pre-production showing typical poses and "extremes" of movement and expression for each individual character; in addition to full-length figure drawings of the character, these sheets will often include details of how the head and/or hands are to be drawn; an animator follows the model sheet to keep each drawing of the character "on-model."

Modeling (in CG): step-by-step creation of virtual objects or geometry in the digital/computer environment.

Monitor: computer screen.

Mo-cap (motion capture): process whereby the physical movements made by an actor or performer are tracked in real time within a studio space equipped with motion sensors; the resulting spatial coordinates of these movements are then fed into the computer and, in most instances, applied to a digital model, the basic geometry of which resembles the performer sufficiently that the digital character can copy the movements made by the live performer.

Motion control: computerized hardware and software that controls the position and/or velocity of animation and live-action cameras.

Multiplane camera(s): an animation camera stand designed to accommodate multiple levels of cel and painted animation artwork, each level positioned on a separate glass shelf equipped with moving peg bars controlled by calibrated gear wheels.

Notches: perpendicular marks made along the length of a line that indicates the planned trajectory of a camera move on a camera diagram, each notch representing the camera center at each successive frame. Also used to describe similar marks drawn by the camera operator on a length of masking tape that is fixed to the "tower" or vertical camera support to act as a guide for the frame-by-frame repositioning of the camera as it approaches or retreats from the artwork on the compound table.

OL: see artwork, background.

On camera: visible to the camera lens.

On model: see model sheet.

On ones: character or special effects animation that is created using twenty-four separate drawings for each second of on-screen time; the term is used to distinguish full animation from limited animation in which, for example, only twelve drawings will be created for each second of on-screen time, every one of the twelve drawings being photographed twice to compensate for the missing alternate or in-between drawings.

Opaque-ing: the process of adding a final layer of paint to the underside of a series of animation cels to make sure the entire painted area of the animated character is fully opaque, thereby allowing the cel or cels to be photographed back-lit so that a separate matte run of plain black character silhouettes can be created.

Operator (rostrum camera): the person responsible for operating and maintaining the animation rostrum camera.

Optical printer: precision-engineered predigital device (used in its earliest form to create copies, enlargements, and reductions of individual still photographic images) that combines a movie camera with a projector (or projectors) to enable multiple successive exposures of different artwork and matte elements onto the same length of original film negative; used to composite complex multi-component special visual and photographic effects, but also commonly used to create simpler mechanical effects such as wipes, dissolves, and fades from (or to) black (see also aerial image photography and bi-pack).

Overlapping action: animated action in which, for example, a character's hair or clothing comes to rest after the character itself has stopped moving; animated action showing similar cause-and-effect or chain-reaction movements; generally used to add realism, but time consuming so therefore less common in some forms of limited animation.

Overlay: see artwork, background.

Pan/panning (camera movement, artwork movement): abridgment of "panoramic," used to refer to a smooth, lateral movement of the camera; the term "vertical pan" is also used, although this is sometimes known in live-action as a tilt because it is often achieved by tilting a camera mounted on the fluid head of a tripod.

Panning paper: sheets of animation paper that are wider than one single field guide and require more than one set of peg-hole perforations; generally used to accommodate continuous animated action that requires more than one page-width (or field guide area) to complete; can be used horizontally or vertically.

Parallax: natural visual phenomenon in which objects at a distance from us appear to remain stationary when we move relative to them while those objects that are closer to us come in and out of our field of vision and therefore appear to move; for example, viewed from the window of a moving train, the moon will appear to remain in one place while the trees and buildings that are close to the track appear to speed past.

Particle systems: computer software programs that determine the creation, behavior, and on-screen life span of tiny digital objects which operate in groups to simulate complex natural phenomena such as fire, water, or dust particles. Often now used in preference to hand-drawn special effects animation techniques.

Path of action: the line of movement to be followed by a character or camera in any given scene, usually indicated on one or other level of layout artwork (see also notches and trajectory).

Peg bar: narrow, flat metal registration strip usually equipped with two rectangular metal pegs sitting equidistant from a single round center peg; used to hold specially perforated sheets of

animation paper and cel in place, and to ensure continuity of movement in animated characters and precise registration with scenic objects and other elements from one drawing to the next.

Performance animation: alternative term for character animation; animation in which the acting and attitude of the figure are particularly noticeable.

Physical camera(s): regular movie cameras as distinct from the virtual cameras that exist only within the digital computer environment and are therefore intangible.

Physical space: term used to distinguish real 3-dimensional space from the virtual space represented by the x, y, and z axes of the digital computer realm.

Pipeline: the various production departments in an animation studio, arranged or thought of in the order of the sequence of tasks they perform.

Pitching (a storyboard): the act of presenting the storyboard for a particular animated sequence to an audience usually consisting of the director, the writers, and the department leads.

Planning & checking boards: see bottom pegs.

Plate (photographic, background): term used to describe a single hand-painted, photographed, or digitally rendered image representing an environment; similar to a theatrical backdrop.

Platen glass: sheet of glass, usually fixed to the "compound" tabletop of a rostrum camera with a hinge; designed to press down on one or more levels of cel and/or opaque character, OL, UL, and BG artwork to keep it flat during the photographic exposure of each frame.

Plus (verb): to build or improve upon the work that arrives on your desk or in your department.

Point of view (POV)

In camera: any shot in which the camera is positioned to capture or show what a particular character in any given scene would see from his or her own specific position, height, or angle of view.

In story/narrative: the individual subjective attitude of any particular character in a story as indicated

by his or her expressed opinions, judgments, and observations or, where the story is being told by a person not involved in the events being described, the narrator's objective recording or reporting of the action and dialogue of the characters.

Polygon: multifaceted piece of digital geometry.

Popping: effect on the eye of dissimilar drawings or pieces of artwork appearing in adjacent frames within the same scene (e.g., in a pose, Leica, or story reel); when viewed at 24 frames per second this results in a sudden and distracting jump in the on-screen image known as a "pop." Similarly, a paint pop results from the wrong color of cel or digital paint being used to fill in an area on an animated character in one or more adjacent frames.

Portrait: term used to refer to a vertical rectangular image format or composition, as opposed to landscape, which refers to a horizontal rectangle.

Pose drawings (layout/character animation): see character layout(s).

Pose reels: filmed and timed version of the storyboard (or story sketches) for an animated short (see also animatic and story reels).

Posing the action (in an animated movie or series episode): making rough sketches to indicate how the main characters will be positioned within each scene and sequence, with attention being paid to how the character animation will "read" against the background and scenic elements.

Postproduction: those parts of the movie-making process that take place after the filming or animation itself has been completed; in live-action, editing is usually considered to be part of the postproduction process; in animation, the editor is closely involved also with preproduction work, in particular on the story reels or animatic; sound (and some music) recording also has to be done ahead of time in animation so that the animators can synchronize the characters' performance and facial movements to the voice actors' dialogue.

Preproduction: those parts of the moviemaking process that take place before the filming or animation itself begins.

Previz (previsualization): the process of creating simple, lo-poly geometry in preproduction to

represent the characters, props, and environments so that the director and the production team can experiment with them, either by navigating a path through the virtual environment in real time using a digital camera or by creating lo-res renders of camera moves and action sequences as they might appear in the finished movie.

Final print (of an animated movie or series episode): the final film copy (usually created on 35mm film stock) of an animated production, used either for broadcast or for production of the required distribution prints for theatrical exhibition of a movie.

Processing speed (of a computer): the speed at which a computer can work with (or manipulate) the binary information that is fed or programmed into it.

Production design(er) (live-action and animation): the person responsible for working with the director to establish and maintain the overall look of a production from original visual research through to final choices about props, furnishings, costumes, and color schemes.

Projection camera: digital "camera" capable of projecting a scanned-in or hand-rendered 2-dimensional image (such as a rendering of scenic detail) onto 3-dimensional computer geometry.

Props: objects and items with which characters interact (e.g., books, weapons, umbrellas).

Proscenium arch: the opening at the front of a theater stage, usually rectangular rather than arched in shape, behind which the curtain rises and falls.

Quota: the target amount of work required from any production department in a given week.

RPG (role playing game or gaming): computer games involving the player assuming the identity of a fictional character; "deep" RPG being a particularly complex multiplayer form involving numerous different characters, levels, and interactive challenges.

Ratio: in both regular and multiplane animation photography (or digital scene compositing) for hand-drawn animation, it's necessary to calculate in advance the different speeds at which the various

levels of "flat" artwork have to move relative to one another in order to achieve the desired effect of perspective and depth; these differences in speed are referred to as "ratios" (see also parallax).

"Reading" an image: see legibility.

Reels: common abridgement of story reels (see also Leica pose and pose reels), e.g., "getting the movie up on reels."

Registration, registration lines: in hand-drawn animation, characters painted on cel often need to appear to pass behind objects (e.g., an armchair or a door frame) that are rendered as part of a single, flat background painting; the simplest way to accomplish this illusion is for the inker (or tracer) to trace the outline of the object in question so that each frame of the character is painted only up to that line. As Dan St. Pierre explains: "The special effects artists tend to use a red line for registration. If it's the edge of a table or something, there will be a very fine, clear indication, absolutely precise, so that the background painters can paint precisely to that line and then the character clean-up artist would clean up precisely to that line, so the characters look like they interact with the painted object, even though there's no separate OL or OL/UL component."

Rendering

Computer: the process in which binary information is translated into visual or pictorial information by a computer.

Illustrative: the creation of shading, tonal, or modeling effects in a drawing (as distinct from the drawing of an outline).

Resizing (drawings): enlarging or reducing animation drawings (usually the latter: necessary when hand-drawn animated characters have to appear in the distance, making it particularly difficult to draw them accurately in any detail at the size they will appear in the final frame).

Resolution (of images): the quality of an image as displayed by, scanned into, or printed from a computer; generally governed by the number of pixels or "dots per inch" (dpi) in the stored (or printed) version of the original image.

Reuse (noun): when one or more individual pieces of character or 8G artwork appear in more than one scene or sequence, this is referred to as "reuse"; when, over the period of production work on an animated series, a sufficient number of commonly seen repeating actions have been animated, those drawings that can be reused again and again in different shows or episodes are referred to as "stock" animation.

Reverse angle (camera): term used most commonly in the filming (or animation) of a conversation between two characters; if the scene begins with the camera pointing over the shoulder of the lead character at the face of a secondary character, those shots in which the camera is then positioned behind the secondary character so that the lead character's face can be seen.

Rigging, facial (computer): of digital characters, connections of digital surfaces to the digital armatures or skeletons that will support them and govern their movements.

Rolling (animation drawings): similar technique to flipping a group of drawings, but usually done by detaching the key, breakdown, and in-between drawings from the peg bar, rearranging them in sequence, and holding them up to the daylight where they can be thumbed through like the pages of a book, with one sheet after another dropping down so that a group of more than three drawings from any given sequence can be viewed in order (though not in real "screen" time); can also be done, if preferred, with the drawings fixed in sequential order on the peg bar.

Rostrum camera stands, operators, tables: see camera, rostrum, above.

Rotoscope/ing: technique developed and patented by Max Fleischer in 1917 (U.S. Patent number 1,242,674, filed December 1915, granted October 1917), which allowed movie footage of a live performer to be projected onto a surface from which an artist could then trace the outlines of the figure, one frame at a time; the specific design and rendering style of the drawn character could then be modified to produce a hand-drawn "animated" performance based on the live original; this technique was used extensively in the Flesichers' *Out of the Inkwell* series and later in both of the studio's feature-length movies.

Scanners/ing (of animation artwork): while traditional (flat) cel and scenic artwork were still routinely being photographed using a rostrum camera in European and American studios until the 1990s, it gradually became more common for all of the artwork, from storyboard panels to finished background paintings, to be placed in a flatbed scanner, similar in design to a photocopier; once scanned in this way, the pictorial information is digitized within the computer, allowing each image to be moved and manipulated in whatever way the production requires; people commonly talk about "scanning in" animation artwork, i.e., bringing it in to the computer environment.

Scene planning (animation for film and TV): the department in a traditional animation studio responsible for working with the director and the layout crew to establish how best to shoot each scene, calculating the precise movements of each artwork component and of the camera itself.

Scouting locations (real and virtual): exploring a physical or digitally modeled set or location such as a cityscape or large exterior location with a view to finding the best potential performance spaces and camera viewpoints.

Scratch dialogue (and music or sound effects): temporary dialogue tracks that are recorded in preproduction for use in the story reel or animatic, usually performed by studio staff and crew members, before the final casting of professional actors has been done; temporary music and/or sound effects.

Screen ratio: see aspect ratio.

Sequence: term used in production to describe a particular group of scenes which, when viewed together, tell one specific part of a film's story.

Sequence key: a piece of color artwork that defines or exemplifies the required look for a particular animated sequence in terms of color, rendering style, and lighting.

Series, animated: production designed for TV or Internet broadcast, usually in weekly episodes of approximately 25 minutes' length, the term can also be applied to any group of theatrical-release animated movies of a similar format (see shorts) that feature the same animated characters in

different comic or dramatic situations (e.g., the Fleischer Studios' *Superman* series, the MGM *Tom and Jerry* shorts, or the Warner Bros. *Looney Tunes*).

Set dressing (in theater, live-action, and CG animation): the process of choosing and positioning props, smaller furnishings, and incidental items in a set (usually specific to a character's personality).

Sets (live-action and animation): scenery and furnishings designed, collected, and/or constructed specifically to create an environment for a theatrical or movie performance.

Shader (CG): a computer program that dictates the manner in which a particular surface texture will be applied to a piece of digital geometry (e.g., a "chrome" or "wood grain" shader).

Short(s)/short format (animated films): animated movies, made either individually or in a series, that always feature the same characters; shorter than a 30-minute TV episode or a 90-minute feature; throughout the '40s and '50s the average length for an animated short was approximately 7 minutes.

Silhouette: term used to refer to the best possible "shape" that an animated character can present to the camera in any particular key pose. In particular, lead animators and assistants are encouraged to position characters arms so that they would remain clearly visible, even if the entire character shape were to be filled in with black paint instead of being "swallowed," for example, by the bulk of the torso.

Sky card: a piece of art board, paper, or card onto which an area of simply rendered sky or clouds has been painted, usually for use as a neutral, nondistracting background. See color card.

Slate/slating: used to identify each shot for the laboratory and the editor. In silent films, the identification was written in chalk on a slate, hence the term "slating." When filming with synchronized sound, a clapper board is hinged at one side and "clapped" shut in front of the lens as the scene number is announced. This provides both an audio and a visual marker to help synchronize sound and picture in the cutting room.

Slow-motion photography: movie photography in which the film is run through the camera at a speed faster than 24 frames per second, the resulting projected image giving the impression of regular movement happening more slowly than would be perceived in real time by the human eye. See time-lapse photography.

Sneak(ing): term used in character animation to describe a slow, stealthy style of walking.

Special effects: see artwork, effects.

Splicing, film: the technique in traditional pre-digital moviemaking of joining one piece of "cutting copy" film print (or original negative) to the next by means of either clear adhesive tape or cement/glue.

Staging (a scene, show, or action): working out in advance of live performance or character animation where the performers should appear in relation to one another within the rectangle of the screen and how their movements should "read" against the environment when seen from the chosen camera position(s).

Staging pass: the point in preproduction when a storyboard is reviewed to see where staging decisions can be improved or clarified.

Stills photography (as distinct from movie photography): the photography of single images not necessarily designed to relate to any other image or images.

Stock animation: see reuse.

Stop-frame photography: term usually used to refer to the frame-by-frame animation and photography of poseable puppets that are controlled by articulate metal armatures; any movie photography in which the camera shutter and film advance mechanisms are adjusted so that single-frame exposures can be made one at a time.

Storyboard: a collection of small, rough monochrome sketches, usually of identical dimensions and pinned to a large display board, illustrating the actions, events, and exchanges of dialogue described in the written script for an animated sequence; the storyboard is used to plan how each individual scene within a sequence will be staged, animated, and photographed, and helps determine

the points at which cuts will be made from one camera viewpoint to another; sometimes abridged as "board(s).

Story reels: filmed and timed version of the storyboard for an animated sequence (usually in a feature-length animated movie) in which the individual storyboard panels are either photographed or scanned by (or for) editorial so that they can be viewed in real time, accompanied by the scratch (preliminary) soundtrack, including dialogue, music, and sound effects (see also animatic, Leica reels, and pose reels); as the rough, clean-up, and final color versions of each scene are approved on a feature production, these will usually be "dropped in" to the story reels so that the progress of the movie can be seen in continuity.

Supervising animator: in traditional animation, an animator with responsibility for overseeing the animation, assisting, and inbetweening of a particular character throughout a movie or TV production; in CG animation it often refers to an animator with oversight of the animation of all the characters in a particular scene or sequence. In hand-drawn animation, continuity of appearance and proportion in a character can only be achieved once the animation crew for that particular character is familiar with how it has to be drawn; in computer animation the model(s) for each character are predetermined, premodeled, and can only distort when "instructed" to do so, which allows animators to be "cast" according to their talent for particular styles of performance rather than on the basis of how well they draw a particular character.

Suspension of disbelief: see disbelief, suspension of.

Sweet spot: the best possible viewpoint or angle from which a character, scene, or object can be viewed or photographed.

Table (camera): see camera, rostrum.

Take

In character performance: pronounced physical response or facial reaction to something; derived from the theater comedy term "double take," a deliberately exaggerated double movement of the head used to emphasize surprise, shock, or disbelief at something.

In live-action filming: the photography of one specific

performance of a particular scene as captured from a predetermined camera position. If the content and duration of the scene remain the same but the director asks the actors to alter some aspect of their delivery or performance, another version can be photographed (or “taken”) from the same viewpoint. As soon as the camera itself is moved to a different position, this signifies a separate shot as opposed to a different take of the same shot.

Tangible (artwork/mechanical components): real, physical pieces of artwork or mechanical apparatus, created or constructed by hand with real, physical materials (as distinct from those digital or virtual pieces of artwork or pieces of moviemaking apparatus that are built—or appear—only in the computer environment).

Technicians, animation: those members of an animation crew whose role is practical and/or mechanical rather than creative or artistic.

Texture (computer): digital effect applied to the surface of a smooth or regular computer polygon to give it an irregular appearance (e.g., wood grain or fabric).

3D (3-dimensional): term commonly used to distinguish computer animation from “traditional” hand-drawn animation. (A more recent confusion has arisen between “3D” and “stereo,” thanks to the introduction of more sophisticated stereo rendering and viewing techniques.)

Thumbnails: small sketches or designs in monochrome or color.

Time-lapse photography: movie photography in which the film is run through the camera at a speed slower than 24 frames per second, the resulting projected image giving the impression of regular movement happening more quickly than would be perceived in real time by the human eye. See slow-motion photography.

Timing charts: animators’ small diagrams made in the corner or margin of a sheet of animation paper indicating the precise frame number(s) on which the assistant is to create the breakdown drawing(s) and the intervals (regular or incremental) at which the inbetweener is to create the inbetween drawings for a particular hand-drawn movement.

Tonal studies: monochrome sketches or designs indicating the tonal (or lighting) values for a particular scene or sequence.

Toons: abridgment of cartoons, often used to refer specifically to the hand-animated characters themselves rather than the movies they appear in.

Track-laying (sound): the process of synchronizing each of the desired audio elements and individual sound effects with the picture; usually a separate process from the synchronization of either music or prerecorded dialogue.

Traditional: term commonly applied to hand-drawn animation to distinguish it from computer (or “3D”) animation.

Trajectory: the specific path indicated for a character movement (or part thereof) or for a camera move.

Trim (in editing): verb: to remove frames from a scene or shot during editing; noun: the removed frames of film themselves (in a predigital cutting room).

Truck in/out: a camera move in which the camera either approaches or retreats from the animation artwork on the compound table (or camera bed); achieved by moving the camera down or up on the rostrum tower.

Turn-around

CG modeling: a repeating rendered sequence in which a stationary completed model (or item of digital geometry) rotates in front of the camera.

Production: the time taken for a particular scene or sequence to pass through all stages of production.

2-Shot: film scene that is framed to include two characters (often seen in conversation from the waist up).

24 frames per second: the standard speed for movie cameras and projectors.

“2D”: term commonly applied to hand-drawn animation to distinguish it from computer (or “3D”) animation.

UL (underlay): see artwork, background.

Up shot: a shot achieved by placing the camera beneath the performers or action in a scene.

User interface (UI): the various icons, labels, and instructions that appear on a computer screen to tell the user how to operate a particular software package.

Vanishing point(s): the point on a horizon line toward which all horizontal lines in a scene recede and converge when viewed by either the camera or the human eye.

Vaudeville: form of American variety theater popular in the nineteenth and early twentieth centuries; equivalent to the British term “music hall.”

Viewing transform: term used in early computer graphics to describe the assumed (fixed) point in digital space from which any collection of computer-modeled objects would be viewed or rendered; simple precursor to the more articulate digital “cameras” found in most contemporary 3D-modeling and animation software packages.

Virtual (lenses, materials, environments; “realm”): any objects, materials, or devices that appear within a computer display but which have no true physical substance (as distinct from real or tangible).

Wide shot: a shot in which the camera view is broad enough to include a large portion of any location or set or a large number of performers.

Wipe: optical or digital postproduction effect in which one moving image or scene is replaced, frame by frame, by another; traditionally achieved by means of an animating or articulate matte and usually taking the form of a vertical or diagonal line moving from one side of the screen to another, erasing one image and replacing it with another.

Wireframe (diagrams, geometry): term used to describe “raw” digital geometry as it appears on the computer monitor before any shaders, textures, or rendering effects have been applied.

Workbook: scene-by-scene breakdown of an animated sequence presented and compiled in “comic book” form, derived from (and including)

photocopies of the original storyboard panels but including specific written information about the precise nature of the artwork each department must create for every individual scene.

X-sheets: see exposure sheets.

LIST OF INTERVIEWEES (ALPHABETICAL)

Mark Andrews: Oct. 29, 2008
Sunny Apinchapong: Feb. 5, 2009
Ray Aragon: Feb. 7, 2009
Matt Aspbury: Jan. 28, 2009
Rasoul Azadani: Nov. 6, 2008
Tom Baker: Nov. 4 & 10, 2008
Doug Ball: Feb. 12, 2009
John Bermudes: Nov. 3, 2008
Ted Blackman: Nov. 20, 2008
Sharon Calahan: Oct. 28, 2008
John Canemaker: Oct. 21, 2008
Rob Cardone: Oct. 22, 2008
Tom Cardone: Oct. 22, 2008
Arden Chan: Oct. 22, 2008
Deirdre Creed: Nov. 3, 2008
Eric Daniels: Nov. 6, 2008
Geoff Darwin: Nov. 3, 2008
Jeff Draheim: Feb. 6, 2009
Nash Dunnigan: Oct. 22, 2008
Ralph Eggleston: Oct. 28, 2008
Marc Ellis: Nov. 3, 2008
Dave Esnault: Oct. 22, 2008
Danielle Feinberg: Oct. 28, 2008
Dave Figliola: Oct. 22, 2008
Bill Frake: Oct. 22, 2008
Ed Ghertner: Nov. 21, 2008
Charles Grosvenor: Nov. 21, 2008
Victor Haboush: Nov. 7, 2008
Dan Hansen: Nov. 11, 2008
Steve Hulett: Nov. 14, 2008
Tom Humber: Oct. 22, 2008
Don Iwerks: Feb. 10, 2009
Harley Jessup: Oct. 28, 2008
Andrew Jimenez: Oct. 27, 2008
Ewan Johnson: Feb. 13, 2009

Linda Jones Clough: Feb. 2, 2009
Marian Jones: Feb. 2, 2009
Lisa Keane: Feb. 5, 2009
Mark Kirkland: Nov. 21, 2008
Noah Klocek: Oct. 29, 2008
Robert Kondo: Oct. 27, 2008
Nancy Kruse: Nov. 20, 2008
Jeremy Lasky: Jan. 28, 2009
Richard Leinfellner: Jan. 23, 2009
James Lopez: Nov. 11, 2008
Kyle Macnaughton: Oct. 22, 2008
Steve Martino: Oct. 22, 2008
Roy Naisbitt: June 8, 2009
Damon O'Beirne: Nov. 21, 2008
John O'Connor: Feb. 12, 2009
JP O'Connor: Nov. 21, 2008
Mary Alice O'Connor: Nov. 21, 2008
Bill Perkins: Nov. 11, 2008
Jean-Christophe Poulain: Nov. 4, 2008
Kevin "KT" Thomason: Oct. 22, 2008
Charles Trebino: Nov. 3, 2008
Lee Unkrich: Jan. 28, 2009
Bryan Useo: Oct. 22, 2008
Darrell Van Citters: Nov. 14, 2008
James Williams: Nov. 13, 2008
Tanya Wilson: Nov. 3, 2008
Gil Zimmerman: Nov. 21, 2008

E-mail responses:

David DiFrancesco: Mar. 23, 2009
Harrison Ellenshaw: June 11, 2010
Gary Goldman: May 25, 2009
J.B. Kaufman: Mar. 29, 2009
Alvy Ray Smith: Apr. 16, 2009

Telephone interviews:

Brad Bird: Nov. 13, 2008
Don Bluth: Mar. 27, 2009
Spike Brandt: Apr. 22, 2009
Dave Burgess: Apr. 02, 2009
Leslie Cabarga: Feb. 28, 2009
Tony Cervone: Apr. 22, 2009
Jeff Chamberlain: Apr. 15, 2009
Harvey Deneroff: Mar. 1, 2009
Greg Duffell: June 24, 2009
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Kengo Kurimoto: Apr. 15, 2009
John Leatherbarrow: June 26, 2009
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Art Lozzi: May 14, 2009
Phil "Captain 3D" McNally: June 16, 2009
Dave Morehead: Apr. 26, 2009
Scott Morse: Mar. 3, 2009
John Musker: Apr. 16, 2009
Francis Pang: Apr. 15, 2009
Bill Peet, Jr.: Mar. 20, 2009
Ray Pointer: May 27, 2009
Tod Polson: Apr. 2, 2009
Jerry Ragone: July 7, 2010
Lou Romano: Dec. 11, 2008
Matt Samia: Apr. 15, 2009
Dan St. Pierre: Mar. 30, 2009
Chris Wedge: Mar. 5, 2009
Bob Whitehill: July 20, 2009
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FOLLOWING: Combined BG and Character Layout for a scene in an unidentified Roadrunner short from the mid-1960s, possibly for a discarded shot from "Roadrunner a Go-Go" (1965).

Directed by Chuck Jones

BG Layout possibly by Maurice Noble

Character Layout posed by Chuck Jones

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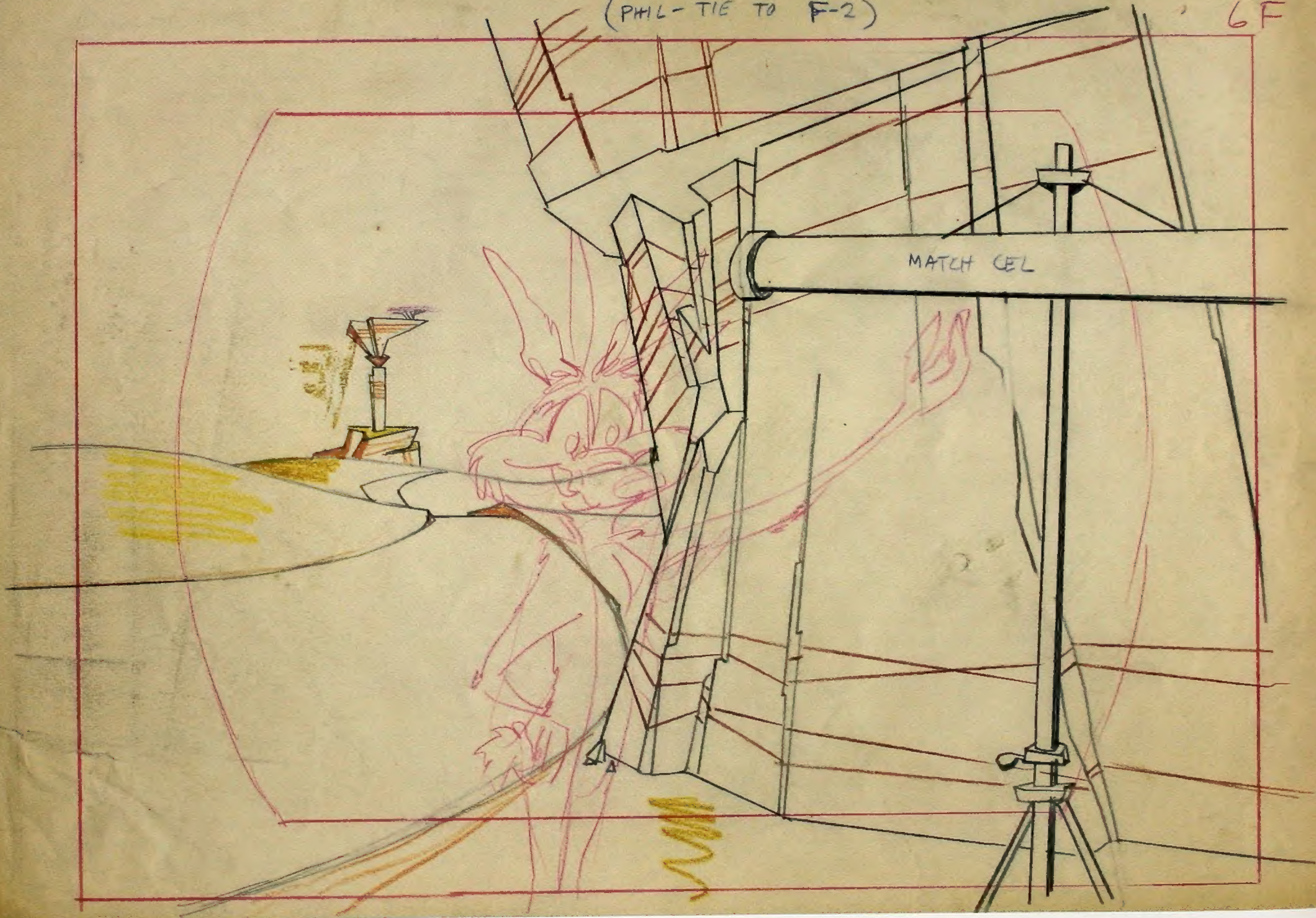
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